Vol. XXX. — No. 3. March 1953.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[656 .2]

Organization of traffic departments,

by W. J. KELLY,

Vice-President, Association of American Railroads, Washington 6. D. C.

The typical United States railroad has a traffic-department head (usually a vice-president); a passenger traffic manager; and one or more freight traffic managers.

Under the headquarters traffic officers come division and district traffic agents, and their staffs. These are the men who, day in and day out, are the shipping public's direct contact with the railroad — the field representatives. On most railroads there are also departments dealing with industrial and agricultural development.

There are no uniform standards applied to the hiring of traffic department employees, or to their training and advancement after they have joined a railroad organization. Most railroads require at least a high-school education. Generally, railroads put new employees to work immediately, believing that familiarity with rates, tariffs, transportation, accounting, organization and correspondence can best be learned on the job. In most cases a knowledge of rates, in particular, is stressed as essential in sales and service training. Some railroads select students, who are given assignments of many types for a year or so before they are located in a clerical position. During this time, they have observed the workings not only of the traffic department, but particularly of the operating department, among others.

Supplementing on - the - job training which the clerical worker receives during his pre-sales period are varying degrees of assistance and instruction. Some railroads conduct group courses, not only on technical subjects, but in such important fields as courtesy, correspondence, and telephone procedures. Courtesy, in particular, is becoming increasingly recognized as perhaps the most vital and necessary ingredient in winning public favor and patronage. Information on the railroad's history and organization, its territory and the industries it serves is distributed through publications and by speakers at group meetings. Inspection trips to important yards and terminals are used quite generally.

While the typical railroad traffic employee graduates from clerical to field work, his education and training thereafter are mostly from experience, aided by association with district and division freight agents — and with other members of the railroad organization with whom he comes in contact.

Railroads, unlike many other businesses, do not pay bonuses or commissions in addition to the regular salary. Outstanding performance is rewarded by commendation and promotion.

The basic records used in sales and service work on carload freight are waybills, freight bills, and passing reports, which give the date, number, origin, shipper, destination, consignee, contents, and route of each car. On-line and off-line representatives and agents collect and assemble these data by shipper and receiver, by commodity, or both, as information pertaining to their accounts, so that performance for any period can be measured against similar periods— commonly the same month last year and the previous month of the current year.

Basic information on carload movements kept by each agency is supplemented by records of other activities, such as cars switched to and from connections at common points, or movements of LCL as reported by local station agents from pick-up-and-delivery and drayage-allowance records. Each district or divisional freight agent then furnishes to the headquarters, at prescribed intervals, the record of operations and performance. The headquarters office then may combine the reports of the field offices, to which he adds other information available to him from his own office or from other offices of the railroad, such as the accounting department's records of local and interline carload movements.

Supervision is conducted mostly by personal contact. The district or division freight agent sees that his representatives maintain a record of the traffic provided by each shipper and receiver assigned to him, and that they maintain a record of calls on each shipper or receiver. He makes occasional calls on shippers with his staff representatives, and has frequent — usually weekly — meetings of his sales staff. Headquarters supervisors follow similar practices, and are in frequent touch as well with heads of other departments.

Most railroads maintain a separate service-bureau organization for expediting and directing carload and LCL freight. The functions of a service bureau, however, must necessarily be individual for every railroad. Each station and district traffic agency is, in effect, a branch bureau. The main service bureau acts as intermediary between the shipping public and the district traffic agencies in tracing and expediting; in furnishing special equipment; in effecting diversion and reconsignment; in checking clearances; in administering embargoes; in handling complaints and delays; and in preparing and publishing freight schedules. Because its work is of a combined traffic-operating nature, the service bureau sometimes is operated jointly by the traffic and operating departments.

The most characteristic and fundamental feature of every service bureau is its extensive communications network, which reaches into every yard, terminal, and office by teletype, telephone, telegraph, and mail. The railroads are continually expanding and improving their communications systems. Their company-owned telephone lines extend into every yard, terminal, station, and office of importance. In addition, private and commercial telegraph lines are used to great extent, as well as railroad and United States mail. There has been an increasing use of air mail in the last few years.

However, the most important and modern development now in growing use on the railroads as the core of their communications system is the teletype. This instrumentality provides instantaneous and accurate reproduction of messages, and detailed statements such as train consists, wheel and passing reports, directed to single or multiple destinations through circuit hook-ups. Sales and service representatives by these means are in constant contact with transportation and traffic activities everywhere on the line.

In the fields of publicity, advertising, and public relations, which are in themselves forms of selling, railroads are active in varying degrees. Publicity and public relations in a typical railroad organization involve such sales aids as the release of spot news, and preparation of feature articles for newspapers, publication of a company magazine, production of educational material and films, and collaboration with other departments on the issuance of company-sponsored documents.

Some railroads have well-established and varied advertising programs, which make use of newspapers, magazines, billboards, and smaller devices such as maps, calendars, blotters and matches. Sales advertising is often directed jointly to the shippers and travelers, with its cost apportioned between freight and passenger accounts.

Of ever-increasing emphasis and importance to the success of the railroad sales program is the attention given today by railroads to research and development. On some railroads separate research departments are maintained under the general supervision of the traffic department. The functions of such a department are to gather a wide range of facts and statistics pertaining to the general economic conditions and traffic performance, so that performance can be measured against known potentials; to conduct exhaustive studies on particular commodities or traffic practices; and to furnish a wide variety of economic and traffic data to management, including forecasts of future traffic that can be used in determining future expenditures.

Many railroads maintain separate bureaus or departments charged with industrial and agricultural development. Their purpose, of course, is to foster the welfare and growth of industry and agriculture in the railroad's territory. The head of the industrial and agricultural development bureaus or departments generally reports to the head of the traffic department. He is assisted by designated agents, but in a very practical sense every district or division traffic agent is — or should be — development-minded.

Railroad industrial-development activities include the following: attraction and establishment of new, permanent industries or temporary industries, such as construction projects, retention or expansion of existing industries, and development of raw-material resources. Gains from new or expanding businesses, and the prevention of losses from abandonment or curtailment of industrial plants are of unquestionable concern to railroads and to the communities and areas they serve. Therefore, railroads and civic, state, and business organizations cooperate to the fullest extent in providing complete information concerning available sites, buildings, and facts on the economic and civic conditions in their territories. In addition, railroads undertake to develop side-track facilities, new buildings, and new sources of raw materials, as well as to find new markets for industries.

Realizing that products of agriculture contribute so greatly to carload revenues, the railroads similarly exert comparable efforts to develop agriculture along their lines. The extent of each railroad's program is determined largely by the nature of the territory it serves. In the main, these activities are embraced in railroad agricultural development: preservation of the resources of agriculture; development of higher-yielding and better-quality crops; improvement of livestock; technological improvements in marketing, processing and distribution; and development of new uses of agricultural products by industry.

[656 .2]

Traffic control method on British Railways,

by R. L. E. Lawrence, O. B. E., M. Inst. T.

(The Railway Executive, British Railways).

The basic administrative unit of the Operating Department of British Railways is the Operating District. Each District is in the charge of a District Operating Superintendent who has, as a part of his headquarters, a Control Office which, under normal arrangements, is manned continuously. Similarly, the Operating Superintendent in charge of each Operating Area, which is a group of Districts, has a Regional Control Office. In the larger Regions, the Districts are placed together in Divisions, and the Divisional Operating Superintendent (who has a Divisional Control) is placed on an intermediate level between the District Operating Superintendent and the Operating Superintendent.

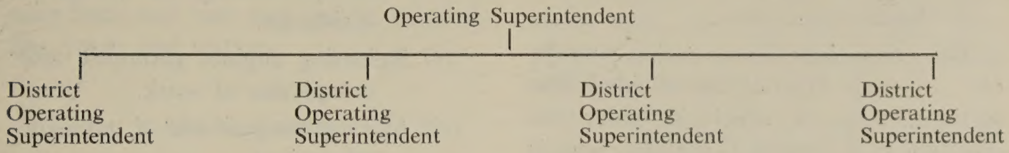

Operating Superintendent
District Operating Superintendent
District Operating Superintendent
District Operating Superintendent
District Operating Superintendent

Diagram 1. Organisation of smaller Operating Area.

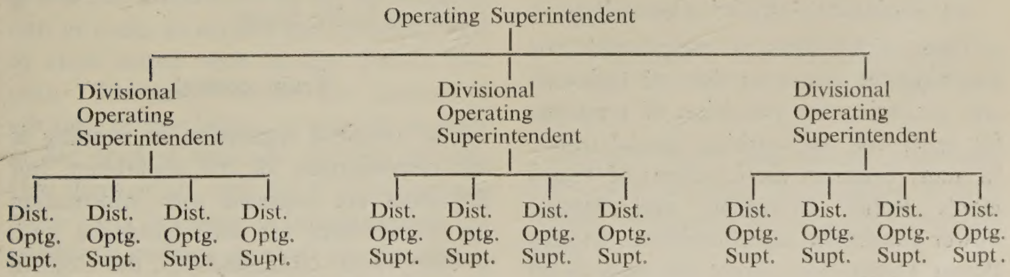


Diagram 2. Organisation of larger Operating Area.

The first step in the organisation of train operation is the production of the plan, i.e. working timetable, trainmen's workings, engine diagrams, etc., and the Control organisation takes over when the plans are put into effect and adjustments are required to meet change of circumstances. The fundamental principle that is followed is that the scheduled working will be maintained, and the Control endeavours to maintain those conditions by issuing directions when there has to be variation of the booked working, and assisting the reversion to normal conditions.

District Control organisation.

The District Control is manned on a three-shift system and each shift consists of the following units:—

(*a*) *Deputy Chief Controller.*

Takes charge of the Control on his shift and acts as the direct representative of the District Operating Superintendent, who is of course the Chief Controller.

(*b*) *Section Controller.*

The component lines, stations, yards, etc., of each District are divided into sections, each of which is under the direction of a Section Controller, who is in telephone contact with stations, marshalling yards, signal boxes, etc.

(*c*) *Trainmen's Relief Controllers.*

These Controllers are responsible for watching the hours on duty of trainmen and arranging the provision of trainmen for relief and for working special trains. In many Controls the functions of Trainmen's Relief Controller and Motive Power Controller are combined. Motive Power Controllers direct the movement and adjustment of unbalanced power.

(*d*) *Assistant Controllers.*

Any one of the other categories of Controller may be provided with one or more Assistants to undertake routine and other work of a less important nature.

Objects of Control.

The objects of Control are :

(*a*) To ensure the expeditious working of traffic including empty stock.

(*b*) To plan and organise the current working of Passenger and Freight trains so as to avoid delay.

(*c*) To obtain the maximum work from engine power and trainmen by :

- (i) Punctal working.
- (ii) Using the fewest locomotives possible.
- (iii) Securing the maximum authorised loading.
- (iv) Incurring the minimum amount of light mileage or unrequired assistance.
- (v) Releasing engines promptly after completion of work.
- (vi) Making the best use of unbalanced engines.

(*d*) To regulate the working of trainmen to ensure economical working and avoid excessive hours.

Train control.

The detailed regulation in running is the responsibility of the signalmen, but the latter are supplied with information by the Control for their guidance and, in exceptional circumstances, the Control gives instructions as regards regulation when conditions justify such action. When the normal working is badly dislocated as the result of mishaps, weather, etc., the Control may have to assume considerable powers of direction in this respect, but the aim is to leave regulation in the hands of the signalmen as far as possible.

Traffic control.

The Section Controllers are supplied with current information of the amount of traffic offering from various destinations by the stations and yards which are within their Sections. Advance information of variations of traffic, particulars of urgent traffic and congestion are also reported currently to the Control. It is then the function of the Controller to adjust the booked services in order to deal with the traffic position to the best advantage with the resources available, and enable free movement over the running lines and into and out of marshalling yards and stations.

Motive power.

As stated previously, it is the task of the Control to ensure that engine diagrams are adhered to as far as possible, and in order to do this the Control keeps in close touch with Motive Power Depots. The latter advise the Control in advance of any failure to provide engines at the booked time, or inability to provide them at all, and the Control in turn gives early warning of requirements for additional engines to work special trains, or of engines that will be returned too late to the Motive Power Depot to take up their booked working.

The covering and reconstruction of broken engine diagrams is the specific responsibility of the Control as is also the disposal of unbalanced engines.

Trainmen.

Records of booking-on times of all trainmen are recorded in the Control, and their hours on duty are constantly surveyed. Where necessary, relief is provided under Control directions, and it is the duty of the Trainmen's Relief Controller to see that the trainmen available for covering reliefs, special trains, etc., are used to the best advantage throughout their shifts of duty.

Control procedure.

The following information is reported currently to the Control by telephone :

1) The composition, engine number and trainmen's particulars (Depot, signing-on time, etc.) of every freight train coming into the District or starting within the District.

2) The particulars of freight traffic on hand for forward working at all stations, yards and Depots.

3) The actual running of important passenger trains and all freight trains.

4) Particulars of any congestion on the running lines or in stations and sidings.

5) The heavy loading of passenger trains and exceptional numbers of passengers for particular trains or destinations.

6) Details of mishaps, bad weather and other exceptional circumstances.

Adjacent Controls keep in touch with each other as regards trains passing between them, as do the Section Controllers within each District Control.

Based on this information the Control

staff initiate whatever action is necessary to adjust the working to achieve the most satisfactory results.

Control records.

The particulars of the loading and running of freight trains are recorded on Train Cards, on each of which the performance of one train can be shown for one week. The only exceptions to this are local trips that remain within the jurisdiction of one Section Controller, which can, if desired, be recorded en masse in Daily Trip Sheets. Special forms are provided for recording the standage and destination of freight traffic awaiting forward movement.

The passing times of important passenger trains are recorded on sheets specially designed for the purpose.

Control equipment.

Each Controller in a modern Control Office is provided with a desk which affords ample room for the manipulation of the various documents that he compiles, and the desks are placed so that Controllers whose work brings them into frequent consultation with each other, are placed as near together as possible. The telephone equipment is so designed that contact is made with the outside staff with the minimum of effort and delay. Conversely, the equipment is devised in such a manner that the attention of the Controller can be obtained quickly when he is called by the outside staff, usually by visual indication or by the use of headphones which enable conversations to be made directly with the Controller without preliminary calling.

In addition to his written records, the Section Controller is assisted by a geographical board which shows the layout of his section on a diagrammatic basis, and upon which pegs can be placed and moved to indicate the position of trains.

Higher control organisation.

The supervision of inter-District working is carried out by the Area/Divisional Controls, and one important feature of the whole organisation is the daily telephone conference. The working in each District for the previous 24 hours, and the anticipated position for the next 24 hours, is examined by the District Operating Superintendent each morning. At a fixed time each day a telephone conference of District Operating Superintendents is held by the Divisional Operating Superintendent (Operating Superintendent in the smaller Operating Areas), and this gives an opportunity for problems of current working to be discussed and dealt with. Similarly, the Operating Superintendents of the larger Areas have a telephone conference with the Divisional Operating Superintendents. Finally, the Operating Superintendents have a brief telephone discussion on a daily conference conducted by the Railway Executive Headquarters.

[385 .57 (44)]

The Central Staff Records Office of the S.N.C.F.,

by René Parès, Chief Engineer, and Albert Renault, Engineer,

attached to the Staff Management Department of the S.N.C.F.

(Revue Générale des Chemins de fer, October 1952*).*

The staff position on the S. N. C. F. was, up to March 1951, known at General Management level by means of periodical statistics drawn up by the different Departments and Regions.

These statistics, which met well defined and limited objects, were often insufficient at a time when problems of all sorts in connection with the staff became of increasing importance; it was still often necessary therefore to consult the Departments and Regions directly when studies or budgetary estimates had to be made, as often happened.

In the case of such investigations, inside a large organization as the S. N. C. F., this invariably meant a relatively long delay.

Now, the factors on which such estimates or enquiries were always based, depended in every case on the administrative situation of the staff which was always known for each of the large organizing units : establishments or regions, in practice responsible for the direct management of the staff.

The standardization — formerly carried out by the « Bureaux des Méthodes de la Direction du Personnel » (Staff Management Offices) — of the documents kept by these different establishments, made it easy to compare such documents. It therefore seemed possible, in order to overcome the difficulties and delays occasioned by the studies and enquiries needed, to set up a Central Staff Records Office, which would collect its information directly from the different establishments and keep a permanent record for each permanent employee by means of a filed « perforated card ». By keeping certain data always up to date, this office would make it possible to follow the evolution of factors in the staff situation, which have a bearing upon the budget; it would also improve — which was a new and very important idea — the accuracy of official estimates.

Quite apart from the problems arising from the estimates required, the General Management foresaw the need to follow a rational staff policy in all the various fields, based to an increasing extent upon as accurate an estimate as possible, the first issue being the recruiting of the staff into a few wide categories.

The central staff records — quite apart from the narrow and somewhat restricted role which can be assigned to it, the substitution of a modern working method for the old ways of preparing statistics by hand and collecting them together which involved a whole mass of papers, — seen in this perspective appear to be the indispensable instrument of a true staff policy, capable, in particular, of avoiding or setting a limit to the very great differences, which occur as regards promotion or admission, from year to year, as the men have found.

The object of the present note is to recall — and this will be both its subject and its plan — :

— the rules on which these records are based;

— the conditions and methods of keeping them up-to-date;

— what periodical information and what information at the time they were first prepared can be obtained from them;

— what technical means and staff are needed to keep them;

— and finally, the first lessons to be learnt from them.

In passing we will endeavour to define the place and importance of these records compared with other large scale mecanographical records.

I. — THE PREPARATION OF THE RECORDS.

Each employee of the S. N. C. F., since July 1938, has been registered as a member of the S. N. C. F. social insurance scheme, known as the « Caisse de Prévoyance », and been given a seven figure number, the first two numbers indicating the year of birth, the next five simply being the chronological order in the year of birth.

Example : No. mle 04 10 565.

04 being the year of birth : 1904.

10565 the order of registration for the year 1904.

This registered number which serves as an identification for each employee by itself — or at least making it possible to find the correct card filed according to the department concerned — naturally remains the characteristic factor for each employee as far as the Central Staff Records are concerned. But the characteristic index of the department, according to a code which will be explained later on, is always joined to the registered number of each employee.

Original record card and perforated cards.

The records are based on details applying to all permanent members of the staff as at the 31st March 1951; these details were recorded by the staff office on the original record card which is 13.5 × 21 (5 1/4 × 8 1/4 in.) (fig. 1) positively in certain cases and in the others according to an agreed code of figures; a total of 13 codes were needed.

The time allowed for the preparation of these original record cards was extended by three months from the 1st April to the 30th June 1951.

The record covers the following main points :

1. *The original position :*

Registered insurance number, date of birth, years of recruiting, commission and affiliation to the pensions scheme.

2. *Recruitment and career :*

Training, position at admission, commencing grades as at the 1st January 1938 (when the S. N. C. F. was formed) and as at the 31st December 1947 (before regrouping).

3. *The position as at the 31st March 1951 :*

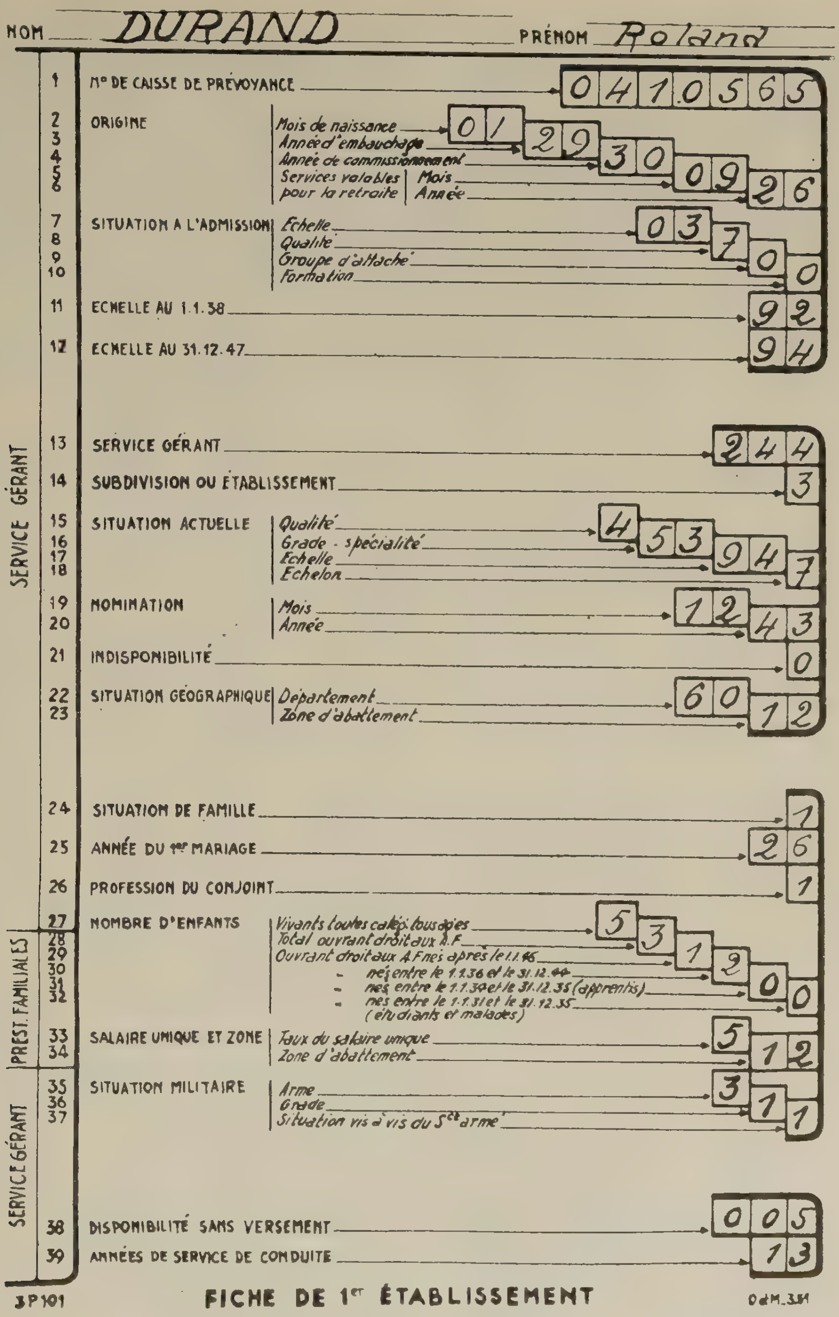
Complete administrative situation (ranks, scale, grade, Region, Department, area, category); geographical position (department, zonal basis for the calculation of family allowances); demographical position (family, year of marriage, number of children); military position (situation, grade, corps).

4. *Special information.*

Possible availability and time spent as a driver.

The essential features of the original record were very carefully studied so as to make it easy for the mecanographical operators to transcribe by means of perforations on a card all the details given. For this reason, the perforation grid was put on the right hand side and all information having any analogy was collected together *on one and the same line*, to avoid as far as possible any vertical readings having to be made by the operators.

In the same may two different colours were adopted to distinguish between male and female employees, and the information is so arranged that the perforations can be divided up into several groups by automatic « jumps » in order to avoid having



NOM DURAND PRÉNOM Roland

	1	Nº DE CAISSE DE PRÉVOYANCE		0410565
	2	ORIGINE	Mois de naissance	01
	3		Année d'embauchage	29
	4		Année de commissionnement	30
	5		Services valables pour la retraite — Mois	09
	6		Services valables pour la retraite — Année	26
	7	SITUATION A L'ADMISSION	Echelle	03
	8		Qualité	7
	9		Groupe d'attaché	0
	10		Formation	0
	11	ECHELLE AU 1.1.38		92
	12	ECHELLE AU 31.12.47		94
SERVICE GÉRANT	13	SERVICE GÉRANT		244
	14	SUBDIVISION OU ÉTABLISSEMENT		3
	15	SITUATION ACTUELLE	Qualité	4
	16		Grade - spécialité	53
	17		Echelle	94
	18		Echelon	7
	19	NOMINATION	Mois	12
	20		Année	43
	21	INDISPONIBILITÉ		0
	22	SITUATION GÉOGRAPHIQUE	Département	60
	23		Zone d'abattement	12
	24	SITUATION DE FAMILLE		1
	25	ANNÉE DU 1er MARIAGE		26
	26	PROFESSION DU CONJOINT		1
	27	NOMBRE D'ENFANTS	Vivants toutes catég. tous âges	5
PREST. FAMILIALES	28		Total ouvrant droit aux A.F.	3
	29		Ouvrant droit aux A.F nés après le 1.1.46	1
	30		- nés entre le 1.1.36 et le 31.12.44	2
	31		- nés entre le 1.1.30 et le 31.12.35 (apprentis)	0
	32		- nés entre le 1.1.31 et le 31.12.35 (étudiants et malades)	0
	33	SALAIRE UNIQUE ET ZONE	Taux du salaire unique	5
	34		Zone d'abattement	12
SERVICE GÉRANT	35	SITUATION MILITAIRE	Arme	3
	36		Grade	1
	37		Situation vis à vis du Sce armé	1
	38	DISPONIBILITÉ SANS VERSEMENT		005
	39	ANNÉES DE SERVICE DE CONDUITE		13

3P101 **FICHE DE 1er ÉTABLISSEMENT** OdM.3M

Fig. 1. — Original record card.

(The explanation of the French text of the above card is given in the article.)

alterations in the perforations which the operator would only see after having completed a card.

The « jumps » separate the four groups (fixed data, administrative position, demographic position, various details); the blank portion of the card can be used as a spare space should any additional details be needed later.

Finally, in order to facilitate the work of making the perforations which may involve a maximum of 67 taps for each of the 420 000 cards, i. e. a very large total number, the records were divided into eight groups, 4 for the female staff, based on the fact that a certain number of factors in the demographic position (presence or absence of children), in the military position (no military service for the female staff) and in various details (road services for example) only concern part of the staff, so that in this case no perforations will be required.

It may be added that the employees used to make the perforations were to some extent specialists in making out one or other of these 8 groups, and were able to increase their output considerably by a constant working rhythm; in addition, the Mecanographic Office which normally has 4 perforators (and 4 checkers) was able to engage 5 perforators and 4 checkers temporarily to help out.

Finally, after all the data had been perforated, certain details had to be written in in the space reserved for this purpose in the upper part of the card, i.e. :

— the code of the Department concerned;

— the scale;

— the insurance number.

The 7 figure code used for the insurance number has already been explained; the grade is written in for grades 1 to 19, a special code being used for grades relating to the drivers and personnel with interrupted service. The Departmental code has three figures relating respectively to the Region, the Department and the number of the area or organization concerned.

We have dwelt in some detail on the preparation of the original record cards because these were of the greatest importance in view of the short time of three months allowed for completing them; in fact this made it possible to have ready by the 15th July 1951 a total of *420 000* perforated cards, based on information applying as at the 31st March 1951, supplied by the *187* departments directly responsible for the staff of the S. N. C. F.

II. — KEEPING THE RECORDS UP TO DATE.

The first problem which arises in connection with any staff records, in fact the essential problem, is keeping them up to date. It is only natural to look for some method of bringing them up to date periodically : monthly, quarterly, six-monthly, yearly, or even longer, the longest possible period appearing a priori the simplest and easiest.

In the case of the staff records of the S. N. C. F., thanks to the fact that the documents were already standardized, we were progressively led after a thorough study of the conditions to adopt a completely different solution; keeping them *permanently* up to date.

This is quite exceptional in the case of records of such a size, but we were able to do it by having recourse, as suggested, to a small number of operations and the minimum of documents.

a) Factors to be kept up to date.

The first thing was to decide very carefully what varying factors had to be kept up to date.

It was decided that only those factors which had a direct bearing upon the staff costs, i. e. the administrative position, the ranks, the scale, the grade, place of residence, family situation, number of children entitling to family allowances, and the rates of the basic wage.

Purely statistical data (military or demo-

Fig. 2. — La carte perforée.

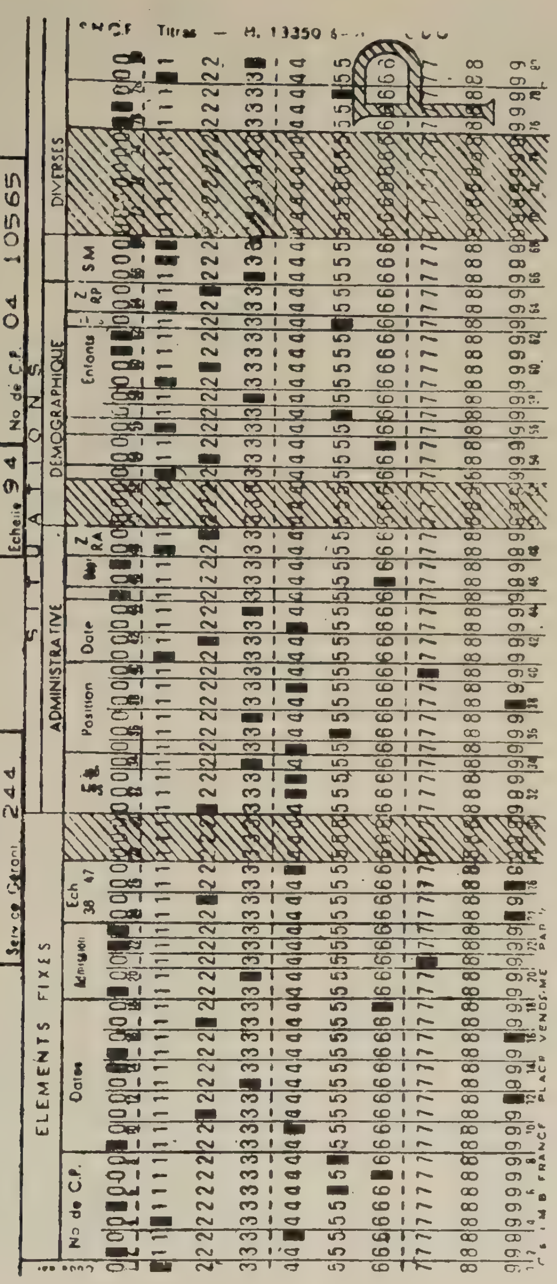


Fig. 2. — The perforated card.

The crossed parts are the columns which are not used, separating the four groups, but which could be used either in part or wholly at a later date.

graphical details) could be added at a later date if this seemed necessary.

Naturally, cards relating to new employees had to be added and the cards relating to employees who had left the S. N. C. F. taken out.

In spite of the limits set, the keeping of the above factors up to date involved a considerable number of entries :

about 27 000 a month :

Change of rank . . .	about	120 000	a year
Change of grade . . .	»	40 000	»
Change of residence (without change of scale)	»	20 000	»
Change of position (minor, major, commissioned, attached) . .	»	18 000	»
Change in position of those absent for long periods	»	15 000	»
Change in family situation	»	10 000	»
Change in number of children entitling to family allowances . .	»	67 000	»
Change in factors affecting the rate of the basic wage	»	5 000	»
New employees (in normal years)	»	15 000	»
Employees leaving (retiring, deceased)	»	15 000	»
i. e. . . .	about	325 000	a year

b) Connection between the Departments concerned and the Mecanographical Office.

Keeping the records up to date in this way involves permanent and continuous liaison between the various Departments and the Mecanographical Office. This is assured very simply by the Departments concerned sending the Mecanographical Office a copy of each of the notices prepared whenever anything has to be reported to the records office (fig. 3).

In this way, by means of these notices of changes, which there is no danger will be overlooked since all of them affect the wages of the employees concerned, the *permanent keeping up to date* of the records can be carried out *without any further new form being required,* without adding anything to the duties of those responsible for the staff.

All the documents sent in simply state :

— a special code number relating to the type of alteration involved;

— the code of the Department concerned;

— the insurance number of the employee concerned,

the administrative details being translated into code as soon as they are sent out by the Department concerned.

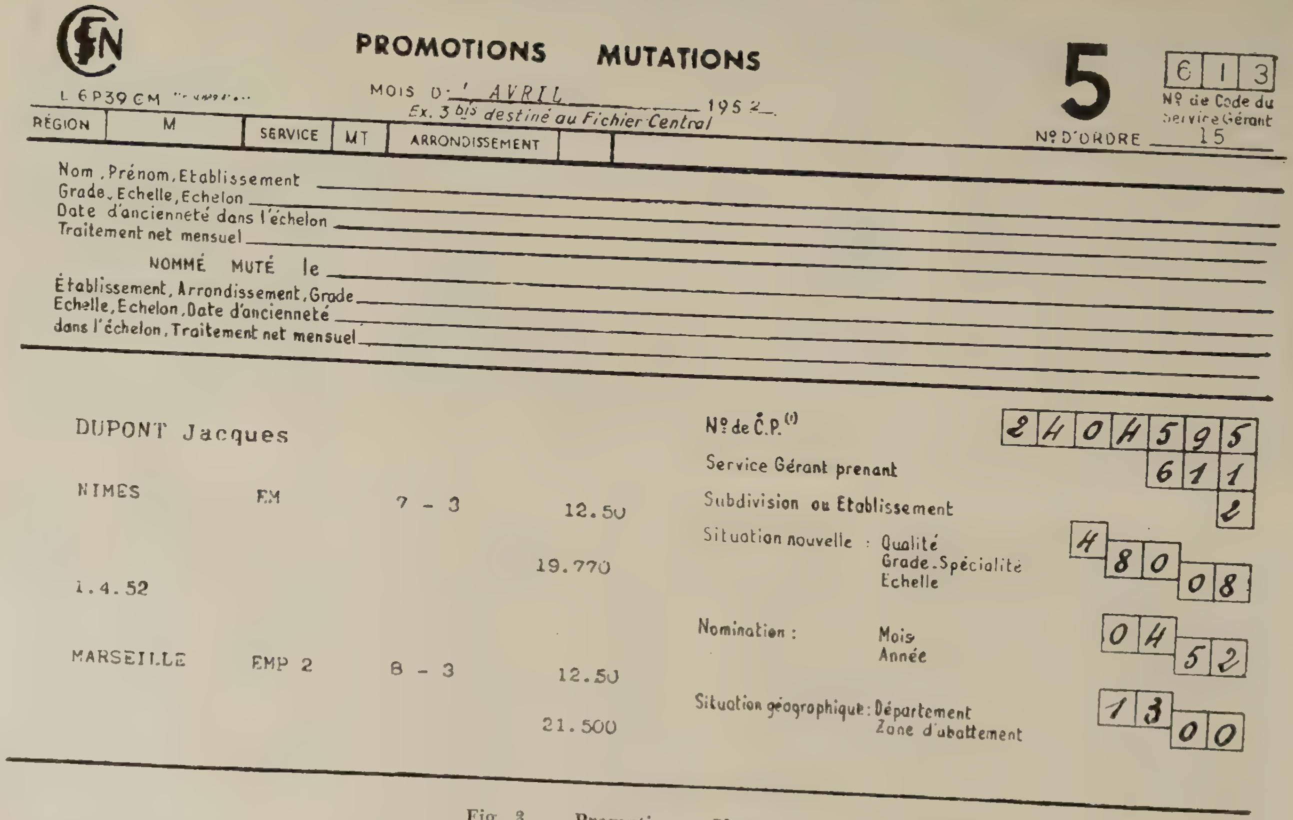
A method of this sort, which includes the essential guarantee that each event will in fact be reported is surely better than any other, in particular the so-called « *pencilled cards* », the classical practice in such cases, which consists in supplying the Departments concerned with special mecanographical cards on which they can indicate in the appropriate space by a simple stroke of the pencil any modification required. The capacity of such « pencilled cards » being in fact limited to 27 columns, each one of them, in view of the fact that the Insurance number takes 7 of these, can only be used for 20 indications of any modifications, and this figure has been found insufficient in practice.

In addition, the correct compilation of these cards by many and widely dispersed employees has led to serious difficulties in the mecanographical operation.

c) Operations involved in keeping the records up to do date.

Keeping the records up to date from the data received from the various Departments concerned is done by means of daily entries, by monthly entries and by quarterly entries under the following conditions.

The perforated cards (420 000 cards) are in principle filed by the Departments concerned, in the order of their insurance numbers; it is therefore relatively easy to find the right card when any notice of a modification is received.



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PROMOTIONS MUTATIONS

MOIS D' AVRIL 1952

Ex. 3 bis destiné au Fichier Central

5

N° D'ORDRE 15

6	1	3

N° de Code du Service Gérant

RÉGION	M	SERVICE	MT	ARRONDISSEMENT	

Nom, Prénom, Etablissement

Grade, Echelle, Echelon

Date d'ancienneté dans l'échelon

Traitement net mensuel

NOMMÉ MUTÉ le

Établissement, Arrondissement, Grade

Echelle, Echelon, Date d'ancienneté

dans l'échelon, Traitement net mensuel

DUPONT Jacques

NIMES EM 7 - 3 12.50

19.770

1.4.52

MARSEILLE EMP 2 8 - 3 12.50

21.500

N° de C.P.(1) 2 4 0 4 5 9 5

Service Gérant prenant 6 1 1

Subdivision ou Etablissement 2

Situation nouvelle : Qualité 4

Grade. Spécialité 8 0

Echelle 0 8

Nomination : Mois 0 4

Année 5 2

Situation géographique : Département 1 3

Zone d'abattement 0 0

Fig. 3. — Promotions. Changes.

This form, which is 21 × 27 cm (8 1/4 × 10 5/8 in.), gives on the upper portion in writing the information given in an abbreviated form on the left hand side in strips, each of which refers to one employee. There are three strips on each form. We have only reproduced above the upper part of the form together with the first strip.

1. *Daily operations :*

Each day, on receipt of the notices of any modifications from the Departments concerned, the corresponding cards are removed from the filing cabinet and those only factors (excluding the changes of rank), which have to be altered, are perforated *onto a new card.*

The two cards, the old one and the new one are kept together for the rest of the month in question.

In the case of alterations in rank, the simplest modification, the cards, after having been taken by hand from the filing cabinet, are mechanically sorted on the old ranks and used for the automatic reproduction of a new card on which the new rank is perforated.

2. *Monthly operations :*

After passing through an intermediate sorting machine, the series of old cards taken out during the month together with the new partially perforated cards, the unchanged data of the old cards are perforated onto the new cards.

The old and new cards are then passed through a tabulating machine and a duplicating machine which makes it possible to keep up to date the recapitulary records, with which we will deal later. These recapitulative cards show the up to date position of the records in a small and very easily handled form.

These operations are therefore carried out in the case of each of the four recapitulative records for which provision has been made.

The old cards are then automatically discarded and the new cards classified according to the Department concerned and the insurance number.

3. *Operations carried out quarterly or when any enquiry has to be made.*

The 27 000 cards or so, prepared in this way every month are filed in a small separate file during the month in question or if necessary for the remainder of the quarter concerned.

At the end of this latter period, or more often when an enquiry is being made, this supplementary file, which may contain as many as 80 000 cards, is incorporated in the general file.

It can therefore be definitely stated that the files are permanently up to date as regards all the variable data which have to be kept up to date.

d) Retrospective bringing up to date.

It was only possible to start bringing the records up to date early in 1952 whereas the original records had been based on the position as at the 31st March 1951. Consequently, it was necessary to begin with to bring the records up to date retrospectively. This task which had to take in account all the accumulated modifications arising since the 1st April 1951, was moreover preceded, during the first few months, by the carrying out of enquiries valid at the original date of the 31st March 1951 and the correction of any mistakes thereby revealed.

The greatest number of these mistakes (1 600 groups, i. e. 3 200 employees) concerned employees who had been given the same insurance number; some cards contained errors regarding the definition of the position and group, other mistakes in the ranks.

Such mistakes were doubtless unavoidable to begin with, but the methods used to bring the cards up to date which involves comparing the codified modified records of certain essential data together with the data previously recorded on the perforated cards in the file, give an automatic guarantee that most errors will be detected and corrected.

Consequently, by the 1st January 1952, the records with all the mistakes rectified were available for use and ready to be kept up to date.

e) Periodic comparisons with the Departments concerned.

In spite of the guarantee against error implied in the methods of keeping the records up to date, it is essential to check from time to time that the records are indeed being kept up to date without errors or omissions.

For this purpose, it is laid down that once a year there shall be a listing of all the cards in use at a certain date, arranged in order according to the code numbers of the Departments concerned and for each of these Departments in the order of the code numbers for the various establishments, grades and insurance numbers.

These listings, which are sent to the departments concerned only, give a few of the fundamental data (training, establishment, grade, department, rate of abatement for the administrative zone of residence concerned, quality, scale, grade, number of children entitling to family allowances, rate of basic wage, rate of allowance for personal residence) which are easy to check against the records held by the department; this should ensure that the filed records are absolutely accurate.

III. — INFORMATION WHICH CAN BE OBTAINED FROM THE CENTRAL RECORDS OFFICE.

The regular compilation of a file of 420 000 perforated cards, each consisting of 67 columns, raises some difficult problems in view of the time it takes to pass all these cards through the recording and tabulating machines.

A recording machine has an output of about 18 000 cards an hour, and the preparation of a single entry requiring for example the use of 4 columns, i. e. passing the cards through the machines 4 times means the machine will be in use for 100 hours; consequently, it is easy to understand why it takes so long to supply a statement suddenly asked for without any preliminary preparation.

These difficulties and the time involved can however be overcome by preparing and keeping up to date a smaller *file* of *recapitulary* cards.

It then becomes necessary to define very exactly as soon as the records are prepared the number and scope of the *periodic statements* recognised as necessary which will involve the preparation of supplementary files of recapitulary cards.

This is absolutely essential if the staff records are to be correctly kept in the case of such a large number of employees and for the rational utilisation of the series of machines available.

If this is done, the actual frequency at which information is asked for has very little effect on the load on the machines, whereas any improvisation will always have a very serious effect.

Consequently, exceptional demands for information, which it is very tempting to formulate when records of this kind have once been made, are strictly limited and only allowed after a very strict preliminary examination into their need.

a) Information supplied at the time the records were prepared or periodically.

Certain information of a budgetary and administrative nature are required periodically.

For example, from the point of view of the budget :

— the distribution of employees by scale, grade and residence allowance rate.

From the administrative point of view :

— the numerical distribution of employees of each grade in each Region and in each Department.

Regarding the position as regards family allowances, the distribution of employees :

— according to the area in which the personal or business address lies and the number of children entitling them to family allowances; according to the rate of basic wage and the zone of personal residence; according to the scale of seniority and number of children entitling them to family allowances.

These latter statements make it possible to estimate very quickly and accurately the total sum due for family allowances, supplementary family allowances and allocations on basic wages.

According to their kind, these periodical statements lead to the preparation of files of recapitulative cards, originally prepared after the enquiry of the 1st March 1951 and modified each month by algebraic entries for staff engaged or released, taking into account the 27 000 or so monthly events reported to the general records.

The size of each of these recapitulative files depends solely upon the number and importance of the coordinates. For example, from the budget point of view, for the first statement mentioned above : Distribution of the employees by grade, by scale and by residential allowance, the coordinates of which are the scales (3 0, including the scales for drivers and staff with interrupted service), the ranks (1 0, including employees on trial), the residential allowances (2 0), the file of recapitulative cards, should all these factors be in fact included, would consist of :

$$30 \times 10 \times 20 = 6\,000 \text{ cards.}$$

In all, the 7 periodical statements, which it has been decided are needed, are made through the medium of four supplementary files of recapitulative cards which contain some 30 000 cards, so that they are already of a considerable size.

b) Information of an administrative order which is only required at relatively widely spaced intervals.

Other information, usually unforeseeable to begin with, may be required at intervals more or less widely spaced.

Such information usually correspond to factors which, statistically, do not vary very much, the knowledge of which may make it possible to sum up a situation or define some operating policy.

The preparation of the corresponding enquiries will necessarily involve a certain delay, which will vary according to the amount of recording and tabulating work involved; it may take a month if all the records are involved (1).

Certain enquiries were carried out when the records were first prepared.

For example, we may quote the two following enquiries :

— The distribution of the staff in the different Departments, according to their year of birth, conditions of employment and groups of scales.

This distribution according to age, made it possible to determine the importance of promotion for those actually employed in each Department; a detailed statement was prepared at the same time for employees belonging to given scales (executives : scales 1 to 9; officials : 10 to 14; staff groups : 15 to 19) and for the different conditions of employment.

— Distribution of the number of officials and staff groups according to year of birth, training and present grade.

Other enquiries have since been carried out, covering not the records as a whole, but only certain groups, i. e. a number of cards limited to some 8 000. These supplied invaluable information on the origins, composition, and perspectives of various kinds affecting the groups of employees.

IV. — MECANOGRAPHICAL MACHINES AND STAFF USED TO KEEP THE RECORDS.

We have given a brief idea of the work involved in carrying out the collection of information by a group of mecanographical machines.

It therefore seemed economical to hand over the management of these files to an existing office, which was already completely equipped and only had to be slightly increased.

This avoided the double danger of insufficient mechanical means being available when an enquiry was being carried out, and a poor user of the machines in between whiles.

The following machines are available in

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(1) There are electronic printing comptometers which would solve all the problems of collecting information from the records without having to modify their classification, i. e. without involving passing all the files through a recording machine, which is a very long job, when any enquiry is carried out. The use of such machines, a rather expensive matter moreover, is not however essential to solve the problems which have arisen so far.

this office (¹) 5 recording machines, 3 classifying machines, 3 tabulators, 1 translating machine, 2 duplicating machines, 5 perforating machines and 4 checking machines.

The average monthly user of these machines for keeping the records up to date and the usual work is as follows :

— recording machines : 90 hours
(output : 18 000 cards/hour)
— classifying machines : 25 hours
(output : 12 000 cards/hour)
— tabulating machines : 60 hours
(output : 4 000 to 9 000 cards/hour)
— translating machines : 12 hours
(output : 3 500 cards/hour)
— duplicating machines : 80 hours
(output : 6 000 cards/hour)
— perforating and checking machines : 60 hours

The staff needed to keep the records is merely an employee of the grade of assistant chief clerk, who spends half his time on this job, two clerks and two filing clerks.

Naturally, the operators of the machines and the perforating machine operators are occupied for the periods indicated above.

V. — RELATIVE IMPORTANCE OF THE CENTRAL STAFF RECORDS OFFICE OF THE S.N.C.F. COMPARISON WITH OTHER LARGE MECANOGRAPHICAL RECORDS.

1. Staff records.

As regards staff records, the records of the S. N. C. F. are undoubtedly those covering the largest number of employees, the only comparable records being those now kept by some large State undertakings or a few large industrial firms (Renault) not exceeding 50 000 employees.

The staff records are used, in general, apart from their definitely statistical object, for preparing the wages. For this reason, they include several cards for each employee, and in practice provide distinct statistical and accountancy records.

The central staff records office of the S. N. C. F. owing to the very large number of employees covered, distributed over the whole of the country, and in view of the

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(¹) We think it useful to recall the essential functions of the machines used.

Recording machines. — Classify, column by column, the perforated cards in ascending numerical order.

Classifying machines assure :

— the classification of two lots of cards recorded in the same order;

— select cards with certain characteristics;

— substitute cards by classifying and selecting them simultaneously.

Translating machine. — Translates into printed characters on the upper portion of the cards certain numerical and alphabetical data.

Tabulating machines :

— produce listed statements, by collecting card by card certain alphabetical or numerical data;

— tabulate, by recording on the comptometers, the perforated data from all the cards or only from certain ones.

The tabulating machine makes it possible to supply statements in a different order to that on the cards.

Duplicating machines :

— reproduce all or part of the data given on a set of cards:

— perforate in series constant data to be included in a record;

— give a recapitulative perforation, when linked up with a tabulating machine, of the data supplied by the comptometers of the latter machine.

N. D. C. R. — The *Revue Générale* published in March 1929 (page 169) a note by M. G. BOLLE on « *the rational utilisation of statistical machines* » (dealing with the general principles, history and the application then being made on the old P. L. M. Railway).

very diverse duties carried out by these employees and the factors on which their wages are based, could not be responsible for the operations involved in paying out the wages every month, which must be done without undue delay, without putting a heavy burden on the operating.

2. Other records.

It is in the field of social insurance that much larger records are to be found, both from the point of view of the number of cards involved and from the point of view of the number of entries to be made every month. For example, the Agricultural Insurance Union keeps up to date records covering 2 200 000 members for each of whom 6 basic cards have to be kept; each quarter in addition a payment's record card has to be prepared and every three years one of the basic cards, the account's card which gives the record of payments made, is taken out of the file, replaced by a new card and destroyed after having been microfilmed in order to be able to store it in the archives in the smallest possible form for use in calculating the pension due to the member concerned on his retirement.

The central staff records office of the S. N. C. F. has no files of this scale. It is however one of the largest records office in France and, in our opinion, that in which the work involved in keeping the records up to date and running the office is assured in the easiest possible way.

VI. — INFORMATION OBTAINABLE FROM THE CENTRAL STAFF RECORDS.

The central staff records office makes it possible to get out very quickly any budgetary estimates required, which was done formerly by means of certain statistics which were prepared every month, but much more conveniently and faster. They give an exact picture of the demographic position of the families of S. N. C. F. employees and consequently make it possible to determine very precisely for example the effects of such and such a proposed measure as regards family allowances (modification in the wages or basic rates, modification in the zonal areas, etc.).

Naturally, they cannot replace the whole of the various statistics which must of necessity be kept in the case of such a large undertaking as the S. N. C. F. at various stages in the management, as they cannot provide all the data needed for getting out such information, especially those concerning the momentary position of employees; in addition, the complexity of the corresponding information makes it impossible in practice for the records to provide detailed statistics of the whole, if such were to be considered needed.

But as soon as it is a question of preparing lengthy detailed and accurate statistics dealing with fundamental factors, such as the age, scale, grade, and origins for the staff as a whole or for such and such a Department or Region, as soon as it is a question of important general problems affecting the general staff policy, the Records are an invaluable and dependable tool for the General Management.

For example, they make it possible to define after a few years the laws governing the promotion of employees from their entry into the service of the railway until they retire under normal conditions, as well as the laws governing the various reasons for which employees leave (reorganization, death, dismissal) before the normal time for retirement. In both these cases, it is a question of empirical laws which we might call administrative mortality, a knowledge of which is needed for getting out the annual budgets as well as for theoretical long term estimates. Such laws can also be established for groups of various grades forming a relatively homogeneous whole, such as executives, supervisors, officials, or for any important group such as : labourers, administrative staff. They can also assist in defining the elements of the policy on which the engagement of staff is based, so as to avoid as far as possible the sudden variations noted in the past.

Such variations show their consequences over long years and can involve at certain times unduly rapid promotion or on the contrary unduly slow promotion, which may discourage some good men.

The records enable the management to foresee as a whole the consequences of too many or too unequal promotions in the past, and can consequently assist them to correct these effects and prevent any such mistakes in the future. It can be of assistance in clarifying and formulating a rational policy for recruiting staff in all grades.

In these various ways, it can be the humble servant of a general management policy.

[625 .142 4]

The corrugated bush in concrete sleepers and the retention of tightness in the rail fastening.

Position towards the end of the year 1951,

by Bruno Neumann, Techn. Rb- Oberinspektor, Minden.

(*Der Eisenbahningenieur*, June 1952.)

A) THE CORRUGATED BUSH.

The corrugated bush (so far called the « grooved bush ») used in the mass production of the new prestressed concrete sleepers of the German Railway System was perfected in 1939 by the former Reichsbahn Headquarters Department in Berlin and thereafter used in the earliest ordinary concrete sleepers. The design of the grooved bush is essentially the work of the former Chief Inspector Mustin.

The corrugated bush is intended to be used with fastenings with and without bearing plates. Provided certain additional measures are taken, it can also meet the requirements of the signalling Department relating to the electrical insulation of concrete sleepered track. It has the great advantage that it can be replaced in the track without interrupting train movements. The experience so far obtained enables us to state that the corrugated bush has proved itself and can be used to make very cheap fastenings.

Figure 1 shows the new perfected *corrugated bush* according to Drawing lotkh No. 122*a* of the Minden Headquarters, dated October 1951. It is made from sound dry red beech impregnated with creosote to a special diagram at the rate of 63 kg/m^3 of wood.

Recently, tests have begun with neutral oils of a lignite or coal base for impregnating the wood. The neutral oils differ from the creosote presently used in that they do not contain any acid constituents (phenic acid), which favour electrical conductivity. The acid constituents are required because of their value as fungicides. It is thought however that in the case of the embedded corrugated bushes the neutral oils will have a sufficiently good fungicide value.

Thorough tests and many series of measurements to determine the value of the electrical insulation, carried out on prestressed concrete sleepers, have shown that the wood bush impregnated with creosote does not in itself give the resistance required. It is possible to get a reliable insulation by separating the steel coach screw from the wood bush by a thin film of bitumen which, when cold and solidified, would not be dissolved by the capillary humidity of the wood in association with the aggressive matters included in the impregnation of the bush. Obviously, it would be useless to coat beforehand with bitumen the walls of the hole in the bush as the film so obtained would be destroyed when driving the coach screw. On the contrary, at the moment the coach screw is screwed in, the bitumen must be sufficiently liquid to penetrate into any pores or small cracks in the wood so as to seal them up.

Tests were made by dipping the coach screw into bitumen but this was not successful as under the action of the considerable friction set up between the coach screw and the wood, the bitumen came up completely. Satisfactory results were obtained by closing the bottom of the hole in the bush by a soft wood plug (fig. 1) and by cutting in the wall of the bush a groove open at the top to act as a valve to let out the bitumen forced up when it is driven.

When preparing prestressed concrete sleepers for insulated sections of the track, the soft wood plug is inserted in the top of the hole, in the bush and is driven with a punch down to the bottom where the hole is smaller. The blocked hole is then half filled with bitumen. When driving the coach screw the excess bitumen pushed out rises through the groove and at the same time spreads over the surface of the screwed part and the plain part during their turning movement. The bitumen coming out of the groove spreads over the surface of the sleeper where it protects the top of the bush from the weather. For this operation, hot bitumen is used. Tests are in hand with cold bitumen but the results are not yet known.

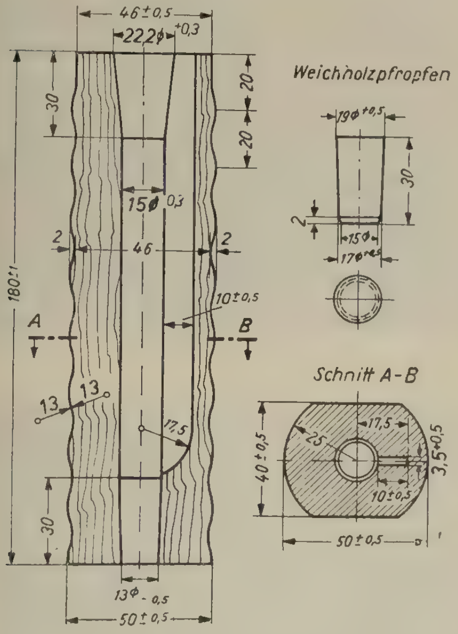


Fig. 1.

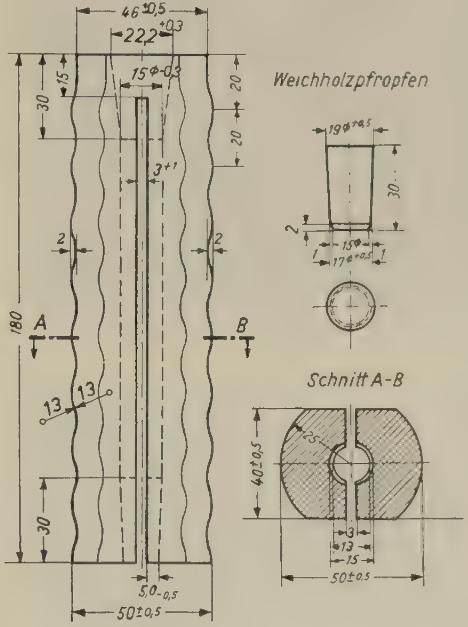


Fig. 2.

Weichholzpfropfen. = Softwood plug.— Schnitt A — B = Section A — B.

These methods of assuring the insulation of the sleepers are as a rule carried out in the shops where the concrete sleepers are made.

The groove 3.5 mm (0.137 in.) wide and 10 mm (0.393 in.) deep cut for the reason given weakens the wall of the bush and reduces the resistance to tearing out of the coach screw because the wood compressed by the thread has a greater opportunity to get away. For this reason the hole formerly 16 mm (0.629 in.) in diameter has been reduced to 15 mm (0.590 in.) in the new grooved bush. The tests showed the resistance of the coach screw to tearing out had not fallen through the groove but on the contrary had increased, probably because from the fact that it could yield the wood was less cut away by the sharp thread of the coach screw.

It is naturally necessary to provide in the future for the replacement of the bush in the sleeper without interrupting the running of the trains. This was the reason behind the « divided corrugated bush » shown in figure 2 (ordering drawing lotkh No. 109*c* issued by the Minden Headquarters, dated 31st October, 1951).

The old bush in two parts designed with that object, consisted of two entirely separate half bushes made by sawing an ordinary bush into two. With this simple method of manufacture which was the only economical one, it was impossible to get the 3 mm (0.118 in.) wide saw cut closely enough on the centre line of the bush for the two parts to be identical. The different half bushes of any one delivery in the loose had such tolerances that only exceptionally was it possible to put them in place properly and get a solid fastening in the sleeper. On the other hand, these tolerances do not matter when the two corresponding parts are kept and put in place together. This is what is done simply with the new « divisible corrugated bush », which is cut to within 15 mm of the top: all that is then needed is to break them into two on the line on fitting them into the holes. While the corrugated bushes of figure 1 are put into position in the moulds, held in position by simple fastenings and then drowned in the concrete, it was necessary to remove them from the sleeper and replace them with the divisible bushes of figure 2, to make use of a *special method of replacement* and to provide *special tool equipment.*

The special tools in a strong steel tool box with lock and key and handle are illustrated in figure 3. The set consists of:

1) two pieces of steel to collect shavings;
2) three 36 mm diameter twist drills with ring bush to control the travel;
3) bush extractor 30 mm in diameter;
4) one 2 to 2.5 kg hammer;
5) one chisel;
6) one gouge;
7) one pair of pincers for removing the shavings;
8) one punch for knocking out the bushes.

The various operations are carried out as follows:

After unscrewing the coach screw and removing the clip as well as if used the bearing plate, the first job is to drill through the old bush.

As shown in figure 4, the twist drill fitted to an extractor is fitted with a ring to limit the travel, which travel can be adjusted as needed to prevent the point of the drill sticking the ballast. The drillings and scraps of wood collect on the pieces of plate resting in the sleepers and which slide under the rails. The lower part of the bush left after drilling as a disc of wood is punched through with the punch by a number of good blows with the hammer.

The chisel is then used to make a number of cuts in the outer casing of the bush (fig. 5). It is then easy to break away the two half bushes from the concrete with the gouge and extract them with the pincers (fig. 6).

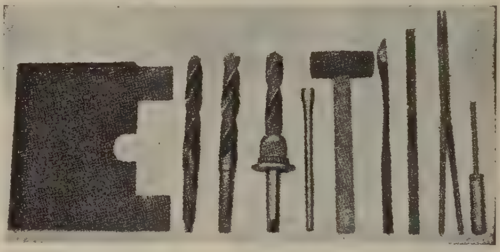


Fig. 3.

The divisible bush to be put in place is then divided into its two parts, one of the half bushes is then put in and pressed into the corrugation of the concrete using the second half of the new bush. Finally, the second half is put in place (fig. 7).

The replacement of the bush is thus completed.

If dealing with an insulated length of track the soft wood plug has to be introduced and the hot bitumen poured in.

It is well to use the *soft wood plug* always. If there is some play between the half bushes and the hole in the sleeper, the plug ensures a tight fit between the corrugation of the bush and hole in the concrete when the coach screw is inserted. This is especially desirable when bearing plates are used as any half bushes which are loose between fitting the bearing plates in place and screwing in the coach screws could get out of line with the corrugation on the concrete without this being noticed. The plug at the same time protects the end of the coach screw from rusting.

The timing of replacements of bushes so far carried out experimentally only, shows that the operation requires per sleeper (4 bushes) on the average 10 minutes for two men. This time is measured between unscrewing the coach screw to its replacement in the replaced corrugated bush and includes removing and replacing the ribbed and intermediate bearing plates. If the works were done in the shops much shorter times would be got by dividing same into the elementary operations with specialised gangs.

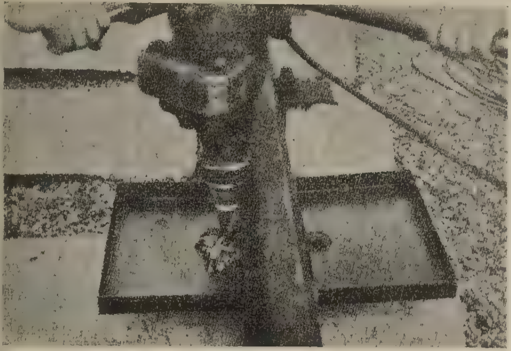


Fig. 4.

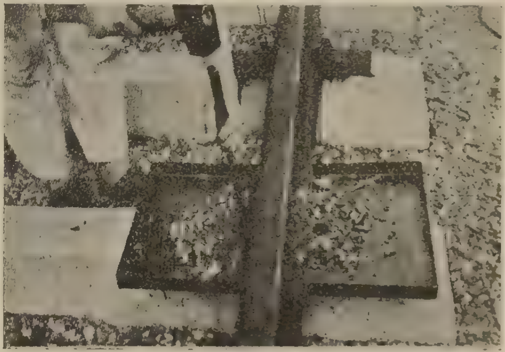


Fig. 5.

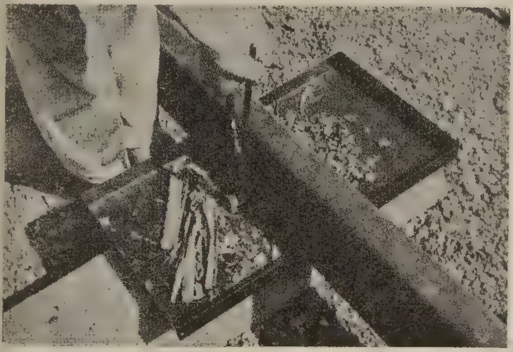


Fig. 6.

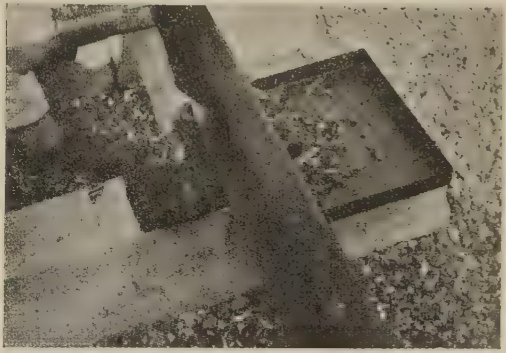


Fig. 7.

To destroy the connection between the coach screw and the corrugated bush in a prestressed sleeper requires a static load of about 7 t and an alternating load of about 4.5 t (with pulsating loads varying between $P_u = 1$ t and $P_o = 4.5$ t, the connection is not broken down after 2×10^6 alternating loads). The comparative tests in tension on bushes put in with the concrete on the one hand and on divisible corrugated bushes put in place subsequently show that the loads to break down the connection are equal in the two cases. The phenomena of destruction however differ. In the first case, the coach screw is torn out of the bush which rests in the hole in the concrete, in the second the divisible bush is usually pulled out of the concrete with the coach screw as soon as the maximum load is reached.

During static tensile tests on corrugated divisible bushes carried out recently it has been found when the two halves of the bushes are pressed with considerable force into the corrugation in the concrete at their lower end the breakdown is by the coach screw tearing itself out of the bush. This result can be got by using a hard wood plug instead of one in soft wood.

To get out of a dried concrete sleeper a bush set in the concrete during moulding a static force of about 10.5 t is needed.

The *advantages of the corrugated bush in beech wood* which lead to its being selected from the many other types of fastenings, are in brief the following:

1) low first cost;
2) cost of fitting small;
3) can be renewed on tracks in use;
4) can be used with all standard coach screws inherited from wood sleepers;
5) cheaper and reliable insulation on track on concrete sleepers;
6) vibration damping element between the rail and the body of the rigid concrete sleeper should vibration phenonema arise.

Attention should be directed here to the need for *correctly screwing in the coach screws.* It is often noticed that powerful coach screw drivers are put in the hands of permanent way men or contractors men without first of all carefully checking and setting the clutches.

If the clutch is set too tight the screws will continue to turn after the head has made contact and the threads will then destroy the fibers of the wood bush. The damage shows by a premature loosening of the fastening which often enough is ascribed for normal reduction of the mechanical strength of the wood of the bush under the sole action of the service loads.

The clutches should be adjusted with the greatest care and a few screws driven as a test each time the machines are used again. The first coach screw should be driven with the clutch set for the minimum load, and it should not be possible to drive it home. A second and other screws should be driven after tightening the clutch each time until a screw is driven home. Care should be taken not to use one coach screw for all the tests as if this were done the increase in couple due to the speed of rotation and the effect of the mass would not have been taken into account.

A machine with correctly set clutch will drive the majority of the screws. The remainder, which brings the machine to a stand before the screws are driven home, ought to be driven by hand. An excessive load applied to the screws can be avoided by driving them by machine to contact with the spring washer and then by hand.

The clutch of the driver must be adjusted to a particularly light load when putting in coach screws that have been taken out. Obviously, the coach screw will go in easily on the threads already made in the bush. The driver as a result runs very fast so that when the head of the coach screw makes contact, if the clutch is tight, the sudden braking of the masses sets up considerable forces which can only result in the destruction of the threads.

Unscrewing and rescrewing the coach screws detracts from the life of the bush. For this reason, in the future, for concrete sleepers the fastenings of which are not separated the ordinary coach screws will be replaced by a shouldered coach screw with nut so that the fastenings can be removed without unscrewing the coach screws through the bushes. The concrete sleepers are delivered on the track with all the screws driven.

B) MAINTAINING THE TIGHTNESS OF THE FASTENINGS.

The most important function of every rail fastenings is to keep the rail tight on the sleeper in spite of the alternating loading and unloading of the track by the passing trains. Let us now examine the question of keeping constant tightness basing our study on a simple fastening as that of figure 8*a*.

We must consider the effect of tightening up the spring washer (F) under the influence of the deformations of the india rubber pad (G) and of the wood of the bush (D). We have to determine the effect produced by the compression of the rubber pad under passing trains.

For this purpose we will limit ourselves to considering firstly the sketch of figure 8*b*, which shows diagrammatically the various parts and the phenomena. The wood bush and its elastic deformation under the tractive effort exerted by the coach screw are represented by the spring D. In this study, we start from the state of the track not under load and in which the springs F and D (elastic washer and wood bush) as well as the rubber pad G are compressed by the load during assembly Z (coach screw) according to their respective elasticities. We wish to know the modification in this state introduced by the load on the track. To what degree will the tightness of the fastening (load due to assembling Z) be diminished?

As in the following study, the elastic displacements of the elastic washer (f_F) of the woodbush (f_D) and of the rubber pad (f_G) are only considered in their very small variations Δf_F, Δf_D and Δf_G and as over these extremely small lengths the curves of load-distance are practically straight, we can take the relations between the load and the displacement as constant and so introduce into each case the notion of flexibility $\left(c = \frac{P}{f}\right)$ in the form of c_F, c_D and c_G.

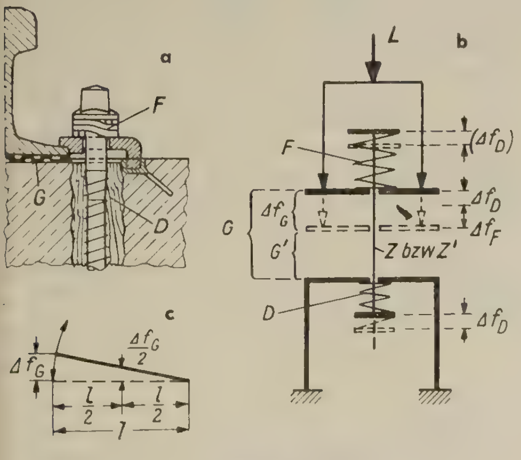


Fig. 8.

If as in figure 8*b*, the load due to the moving train (pressure of the rail) be indicated by L and the tightness of the assembly by Z, the rubber pad will be compressed by the train in passing under the load L by the quantity Δf_G. The tightness Z will be reduced by ΔZ and fall to the value Z'. We then get the following equations:

$$\Delta f_G = \frac{L}{c_G}$$

$$\Delta f_G = \Delta f_D + \Delta f_F = \frac{\Delta Z}{c_D} + \frac{\Delta Z}{c_F}$$

$$\Delta f_G \cdot c_D \cdot c_F = \frac{\Delta Z \cdot c_D \cdot c_F}{c_D} + \frac{\Delta Z \cdot c_D \cdot c_F}{c_F}$$

$$= \Delta Z \cdot (c_F + c_D)$$

$$\Delta Z = \Delta f_G \cdot \frac{c_D \cdot c_F}{c_D + c_F}$$

Figure 8*c* shows that owing to the lever action produced by the bearing plate used here, only half the value of the compression Δf_G should be used.

We then get

$$\Delta Z = \frac{\Delta f_G}{2} \cdot \frac{c_D \cdot c_F}{c_D + c_F}$$

The value ΔZ, indicating the limits of fluctuation of the forces of tightening can be represented by a load displacement diagram like that of figure 9.

The effort — displacement curve of the double spring washer Fe 6 of the triple spring washer Fe 19, are shown on it: below that of the wood bush and below the axis of the abscissae the effort displacement curve of the india rubber pad.

The pad now used by the German Bundesbahn is made with a carefully selected mixture and is 4.5 mm thick. From tests made by the Minden Headquarters, this pad under a rail pressure of 15 t flattens only 0.4 mm under the worst conditions an amount, which does not vary noticeably under varying loadings.

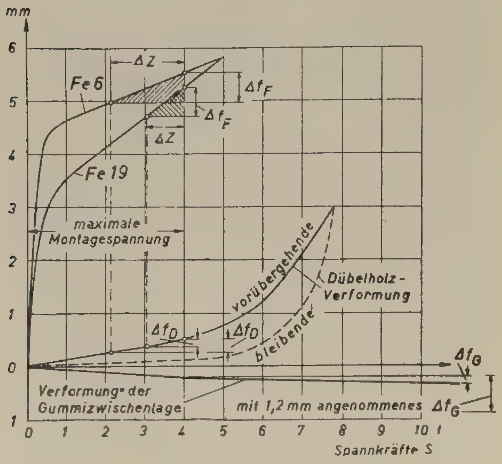


Fig. 9.

Explanation of german terms :

Spannkräfte = tightening pressure. — Maximale Montagespannung = maximum pressure at erection. — Dübelholzverformung = deformation of the wood bush. — Vorübergehende = momentary. = Bleibende = permanent. — Verformung der Gummizwischenlage = deformation of the rubber pad. — Mit 1.2 mm angenommenes Δf_G = value of Δf_G taken as equal to 1.2 mm.

When studying the retention of tightness, we have to take into account the effect that under an initial assembly loading of 4 t the pad loses 0.2 mm in thickness so that the variation looked for is no more than:

$$f_G = 0.4 - 0.2 = 0.2 \text{ mm.}$$

Since $$\Delta f_F + \Delta f_D = \frac{\Delta f_G}{2} = 0.1 \text{ mm,}$$

we see that the slight reduction in thickness of the pad has not great influence on the elastic displacements of the washer and the bush and consequently upon the tightness. This is an advantage of a good rubber pad over that of a poplar pad which gives three times the elastic yield (0.6 mm) and furthermore a permanent deformation of 0.3 mm.

In addition, the life of the rubber pad in the track is much greater than the poplar pad and its use avoids the multiple unscrewing and rescrewing of the coach screws so harmful to the bushes. At the same time, there is a great economy in days of work on the track.

Another consideration is expected to have an important influence on the retention of tightness. In the diagram of figure 9, the curve of the permanent deformation of the wood of the bush due to the load Z has been shown: it is obviously insufficient to affect any variation in the tightness. A superficial examination tends to the conclusion that this permanent deformation cannot be much greater as the load due to the trains would only appear to reduce the load Z acting on the deformation. But this conclusion ceases to be exact as soon as the transverse stresses are considered on straight track and more so on curves in the form of moments turning out the rails and which transmit to the coach screws on the inner file of rails tractive efforts of considerable amount. When these loads become very considerable the deformation of the wood of the bush increases under the action of the repeated loadings whilst the elastic reaction diminishes proportionately so that the tightness Z undergoes a permanent reaction of deformation of the wood of the bush under the action of the trains then adds itself to the increase in the permanent flattening of the pad.

For this reason, in what follows, we suppose that the permanent deformation reaches the considerable value of 1 mm and we substitute for the real value $\Delta f_G = 0.2$ mm of the flattening of the rubber pad the unfavourable value of 1.2 mm. From figure 8*c*, the permanent deformation of the wood bush will be taken as 0.5 mm which has a repercussion on Δf_G of $2 \times 0.5 = 1$ mm.

If, now, the value of 1.2 mm is introduced into the calculation of the change of tightness we get:

$$\Delta Z = \frac{1.2}{2} \cdot \frac{c_D \cdot c_F}{c_D + c_F}$$

in which

$c_D = 8$ t/mm (elastic contant of the wood of the bush),

$c_F = 5$ t/mm (elastic constant of the washer Fe 6), or

$c_F = 2$ t/mm (elastic constant of the washer Fe 19).

The result is:

$$\Delta Z = 0.6 \cdot \frac{8.0 \cdot 5.0}{8.0 + 5.0} = 1.85 \text{ t}$$

for the Fe 6 washer, and

$$\Delta Z = 0.6 \cdot \frac{8.0 \cdot 2.0}{8.0 + 2.0} = 0.96 \text{ t}$$

for the Fe 19 washer.

The two values of the change of tightness (reduction of tightness) ΔZ are shown on figure 9; they show by the difference between the two load-displacement triangles the superiority of washer Fe 19 over washer Fe 6. It shows that washer Fe 19 is much more likely to hold firm during the whole period between two systematic revisions of the track or in other words until the next tightening up of the coach screws. This is why it has been decide to use in future only the triple washer Fe 19 with corrugated bushes for all fastenings with concrete sleepers.

The powerful double and triple elastic washers of figure 10 are sections of cylindrical coiled springs of square section bar in which each spiral has an additional set, the chord of which equals the outside diameter. When the proper elasticity of the spring has been fully taken up, these sets give an additional elastic flexion for a given tightness. (See also on this subject the article « Der hochspannende Federring als Spann- und Sicherungsmittel für Schraubenverbindungen ». — The spring washer of high tightening power for use as locking and safety device in bolted assemblies, by E. FLÖTER, Honorary Reichsbahnrat (Reprint from *Verkehr und Technik*, special permanent way number, 1950). A fastening is properly tightened up when the spring washers are compressed to the extent that the play left between the bent spirals is only about 1 mm (fig. 10).

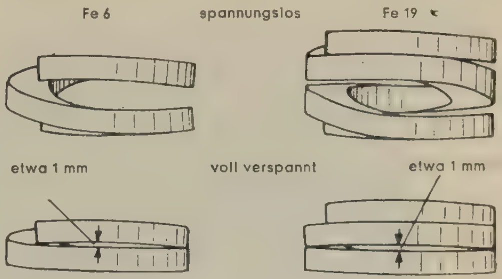


Fig. 10.

Spannungslos = released. — Voll verspannt = pulled up solid. — Etwa 1 mm = about 1 mm.

[625 .173 (43)]

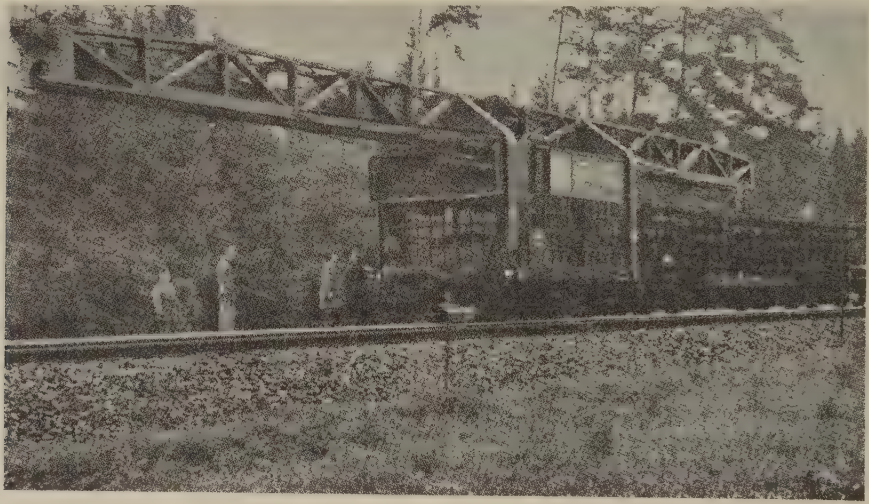
Modern relaying in Germany.

Some 4 1/2 miles of main line were relaid with all-welded track in 12 days.

(The Railway Gazette, February 22, 1952.*)*

A 4 1/2-mile section of the Munich-Rosenheim-Salzburg main line of the German Federal Railways has recently been relaid in 12 days as a continuous welded length without joints. To minimise the risk of rail buckling and increase the life of the permanent way, the new tracks were laid on prestressed concrete sleepers 7 ft. 6 1/2 in. long, weighing 500 lb. By means of two slightly curved reinforcing bar 3/4 in. in dia., a pre-stressing effect of 26 tons was imparted hydraulically so that all the dynamic forces could be safely absorbed.

A ribbed soleplate, screwed on to special-type hardwood plug dowels, guarantees a rigid connection between rail and sleeper. The life of such a reinforced concrete sleeper is estimated at 60 years, compared with some 35 years' life of an ordinary hardwood sleeper, thus compensating for the somewhat higher first cost.



Niemag crane at work. It has just lifted a complete rail length of track from the left, carried it over its cab and unloaded it on to flat wagon on right.

Extensive mechanisation.

During the relaying, single-line working was in operation. To minimise the time of the engineer's possession, extensive mechanisation was used and some of the plant had to be specially designed. About two hundred men were engaged to work day and night shifts.

The old track consisted of 15-m. (49-ft.) rails with wooden sleepers. After removing the fishplates, rail lengths complete with sleepers, were lifted by means of a special Niemag crane, fitted with a travelling winch running on a through longitudinal truss cantilever extending horizontally fore and aft over the track. This is supported at the sides of the crane only, leaving a central space over the crane cab such that the entire rail length can be moved longitudinally above the crane and deposited on a flat wagon standing behind it. This flat wagon formed part of a whole train of such wagons on which a continuous transporter track was mounted.

When the crane had stacked four sections of the old track on the nearest wagon, the whole stack, moving on rollers fitted to the lowest section, was hauled to the farthest unloaded wagon of the train by a cable attached to a locomotive. In this way, it was possible to remove 100 15-m. rail lengths, or nearly a mile of track, a day, a speed seven times greater than hitherto achieved. The crane has a lifting capacity of 4.8 tons, and each 15-metre rail length has a weight of between 3 1/2 and 4 tons.

After the removal of the old track, the ballast bed was first levelled by hand and subsequently compacted by four Vibromax diesel-operated vibrators delivering between 700 and 1 500 blows a min. The rails were then temporarily mounted as conveyor rails, one on each side and clear of the final track bed, and linked together. In this position, the rails carried a special machine which successively dumped and consolidated two 2-in. layers of fine-grain ballast on top of the old ballast.

Sleeper-laying machine running on side conveyor.

Sleeper laying.

The laying of the concrete sleepers was also mechanised. A ballast train loaded with them was pushed forward to the end of the completed track, and the sleepers were slid forward from any wagon to the front wagon along the track extending the length of the train. For this purpose, each sleeper was temporarily fitted with two sliding shoes. At the front end, three sleepers were laid simultaneously by a special device, running on the guide-rails. In this way, the 46 sleepers required for a 30-m. length of rail, were laid in 15 min. Subsequently, the conveyor rails were dismantled and used to form the track itself, which was temporarily linked with fishplates so that the ballast train could proceed.

Finally, the rails, weighing 49 kg per metre (99 lb. per yd.), were thermit pressure-welded together, the joints were filed and planed smooth and, after fettling, the track was fit for traffic at reasonable speed.

[625 .113 & 625 .151]

Recent knowledge on the layout of junctions on curves from the aspect of the curvature,

by M. E. Böse,

Head Inspector geometrician, Hanover.

(*Der Eisenbahningenieur*, No. 4, April 1952.)

Junctions on curves between two running lines whether concentric or not can be divided into two classes according to the form of curvature of these junctions:

1) junction of curvature in the same sense;

2) junction in S form.

In the following study, the junctions with curves of different directions or in S will be considered more specially.

The theoretical investigations the author made to ascertain the highest possible speeds through junctions on curves have shown that the opinion accepted so far as to the general influence of the curvature on connections of this type should be reviewed. According to the Regulations governing the Permanent Way, a straight section is needed between reverse curves when

$$\frac{1\,000}{H_1} + \frac{1\,000}{H_2} \geqslant \frac{9\,000}{V^2} \qquad (1)$$

and

$$\frac{1\,000}{H_1} + \frac{1\,000}{H_2} \geqslant 10 \qquad (2)$$

The result is that on S junctions on reversed curvature over which the maximum speed corresponding to the type of points and crossings used is wanted, it is essential to provide a straight length between the curves. The length of this straight section should be at least $v/10$; in the case of formula (2) the intermediate straight should be at least 6 m (19′ 8 1/4″) long.

We intend to demonstrate that this intermediate straight length has an unfavourable effect on the maximum speed at which trains can run through the junctions. Due to its presence, the maximum speed for the typical turnout is no longer attained on junctions on curves. The author substituted for the intermediate straight length a curve and demonstrates that the speed limits imposed by the straight length disappear. It is not intended to give the impression that the types of curve proposed are something new in principle. Other people undoubtedly will have noted the same effects when studying the layout of lines. Nonetheless the knowledge obtained has never been applied up to the present time to the design of junctions on curves (S type junctions). In any case the author has no knowledge of any publication on the subject. Quite the contrary in fact as in the technical works and manuals of instruction stress is laid on the desirability of providing a straight length between reverse curves with curved turnouts.

To begin with we will show once again that the curvature of a turnout has no disadvantage as regard shock on running on to the points. From this aspect, the maximum speed is found by the formulas:

$$V_{gr} = 3\sqrt{H} \; . \; . \; . \; . \; . \; . \; . \qquad (3)$$

$$V_{gr} = 3\sqrt{\frac{H_1 \times H_2}{H_1 \mp H_2}} \; . \; . \; . \qquad (4)$$

Let us make the calculations for a 49-500-1 : 12 turnout.

For the case shown in figure 1*a*, we have point A: $V_{gr} = 67$ km (41 miles)/h. If $H_1 = 2\,000$ (fig. 1*b*), we obtain at point A:

$$V_{gr} = 3\sqrt{\frac{2\,000 \cdot 667}{2\,000 + 667}} = 67 \text{ km/h.}$$

For $H_1 = 800$ (fig. 1*c*), we get at point A:

$$V_{gr} = 3\sqrt{\frac{800 \cdot 307}{800 - 307}} = 67 \text{ km/h.}$$

The speed must remain constant seeing that in the formulae (2) and (3), we can to equalise the values under the root

$$\frac{H_1 \times H_2}{H_1 \mp H_2}$$

always give the radius of the corresponding straight turnout, that is to say for the 49-500-1 : 12 turnout always 500. In this calculation, however, the only question is the shock experienced at the change of curvature at point A. In addition, the reduction of radius in the branch from an inside turnout makes it necessary to provide superelevation without which the transversal acceleration would become excessive for the branch.

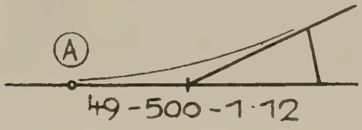


Fig. 1*a*.

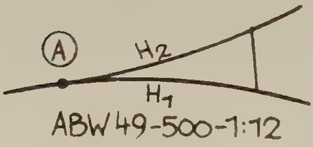


Fig. 1*b*.

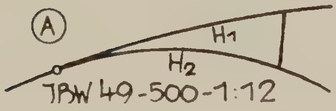


Fig. 1*c*.

$$p = \frac{V^2}{12.96 \cdot H} - \frac{\dot{U}}{153} \quad . \; . \; . \quad (5)$$

The above examples show that with suitable superelevation all curved turnouts can be taken at the maximum calculated speed for the straight turnout.

We will see by an example the influence of the intermediate straight section between curves on turnouts on curves on the speed and on the transversal acceleration.

Between two parallel tracks of $H = 1\,000$ radius a turnout is required to be taken at the speed of $V = 50$ km (31 miles)/h. For straight track the type 49-300-1 : 9 would do. This speed can also be run in the problem proposed (fig. 2).

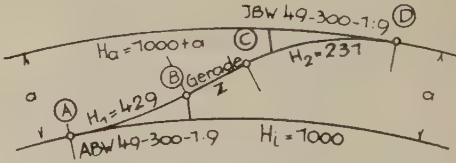


Fig. 2.

Gerade = straight.

Now let us calculate the maximum speeds according to the shocks occurring at the points A to D. We get: at A 52 km (32 miles)/h, at B: 62 km (38 miles)/h, at C: 45 km (28 miles)/h, and at D: 52 km/h. Taking the intermediate straight controlled by the distance between tracks *a* is long enough, the turnout can only be run over at a maximum speed of 45 km/h.

The superelevation of the two running lines in itself cannot improve the speed. To show this, we will also give the diagram of the transversal acceleration. An approximation of the minimum superelevation for $V = 50$ km (31 miles)/h of the turnout with inside curvature ($H_2 = 231$) and the maximum cant of the turnout but with outside curvature ($H_1 = 429$) gives for the running lines a cant of 30 mm (1 3/16″). The tracks to be connected then have a maximum permissible speed of 105 km (65 miles)/h. Figure 3 shows diagrammatically the transversal accelerations.

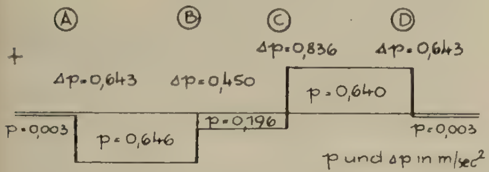


Fig. 3.

N. B. — p und Δ_p in m/sec² = p and Δ_p in m/sec².

This shows the radii to be adequate for the speed. The points A and D (values Δ_p) also allow the speeds asked for. At the point B, the effect of the adjacent straight section has been favourable (Δ_p less than 0.65), whereas at the point *c* the effect was unfavourable (Δ_p above 0.65). At this point the speed $V = 50$ km/h cannot be reached. The cant therefore has not resulted in any change, and the only thing left to do is to reduce the speed for the junction or if the speed of 50 km/h is to be maintained to install two 49-500-1 : 12 turnouts.

In fact, from the economic point of view, the reduction of speed and the use of larger turnouts have an unfavourable repercussion.

A better solution is obtained by modifying the radius of the diverging road with inside turnout at the end of the turnout and inserting an intermediate curve between the ends of the two turnouts (fig. 4). In crossovers between two parallel lines on curves the calculated curve to be inserted between the two turnouts will have within a few metres the same radius of curvature as the roads connected, if it is a question of points of the same opening (angle).

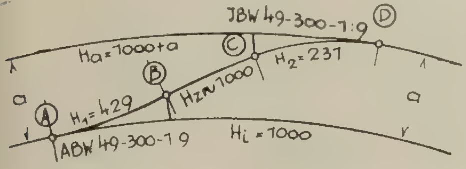


Fig. 4.

As regards shock, the same magnitudes are got at points A and D as in figure 2. The shock at B is the same as at A and C as at D. The comparison of the two methods of calculation show:

	MAXIMUM SPEED			
	at A	at B	at C	at D
Crossover with straight (present pattern)	52	62	45	52
Crossover to new proposal (proposed pattern)	52	52	52	52

If, as before, the tracks of the crossover concerned are given 30 mm cant, in this case we get the diagram of the transverse accelerations shown in figure 5.

The comparison of the values of Δ_p gives:

	Δ_p at A	Δ_p at B	Δ_p at C	Δ_p at D
Crossover with straight (present pattern)	0.643	0.450	0.836	0.643
Crossover to new proposal (proposed pattern)	0.643	0.643	0.643	0.643

The two comparisons show that the type of crossover in S according to the proposed design is clearly to be preferred to the design with intermediate straight length. It allows the speed to be the same as in the case of a crossover between two tracks on the straight.

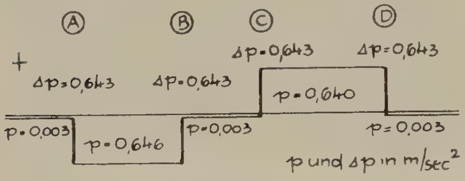


Fig. 5.

The reverse curve as well as the change in curvature meet in each case the Regulations on the construction of the Permanent Way.

$$\frac{1\,000}{H_1} + \frac{1\,000}{H_2} \leqslant \frac{9\,000}{V^2}$$

or

$$\frac{1\,000}{H_1} - \frac{1\,000}{H_2} \leqslant \frac{9\,000}{V^2}$$

There is no need to make the calculations for other examples as the same results will always be obtained for point C. If a straight length be inserted, the speed should vary at point C with all changes in curvature of the tracks since V_{gr} is calculated from $3\sqrt{H}$, and therefore depends on the radius of the turnout of the crossover on the inside. Now in the case of all curved inside turnouts, the radius of the crossover line is necessarily smaller than in the case of straight crossovers.

The advantage of our proposal therefore is that in all cases it is not necessary to use larger turnouts in order that the cant of the lines connected can be adopted to that required for the junction. Up to now, it has always been necessary in cases of this kind to use larger turnouts or to reduce the speed over the junction. Our proposal would effect considerable savings in money and time every year.

Let us now see if the proposed method can be used as well in the case of tracks which are not parallel. We have to take into account here the four following main cases:

1. The distance between the centre lines of the tracks decreases from left to right:

a) the radius of the outer track is greater than that of the inner;

b) the radius of the inner track is greater than that of the outer.

2. The distance between the centre lines of the tracks increases from left to right:

a) the radius of the outer track is greater than that of the inner;

b) the radius of the inner track is greater than that of the outer.

With an intermediate straight length and identical turnouts, we get the condition of curvature shown in figures 6*a* and 6*b*.

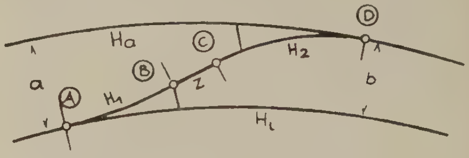


Fig. 6*a*.

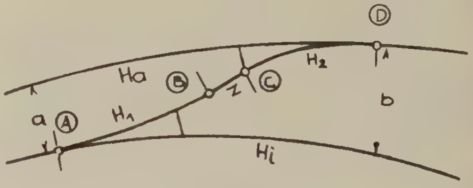


Fig. 6*b*.

At point C the difficulties already found at this point occur again. Let us examine if the methods with intermediate curve can be applied once again. This research will be made once more using examples.

Figure 7 shows an example of the case 1*a* for running over the junction at 50 km an hour.

The calculation of V at the points A and D can be neglected as no difficulty is ever found at these points. At point B, we get V = 52 km/h, whereas at point C, the value C = 54 km (33 miles)/h.

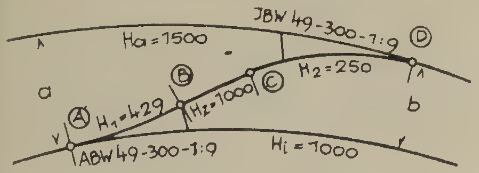


Fig. 7.

In the present case, we have made the intermediate curve the same radius as the inner track. If we had made the curve BC the radius of the outer track $H_a = 1\,500$, we should have obtained for B, 54 km/h and for C, 52 km/h. In other words, if in case 1*a*, we adopt for the intermediate arc BC a radius not less than H_i nor greater than H_a we meet no difficulty as regards speed in case 1*a*.

Let us now consider case 1*b* (fig. 8).

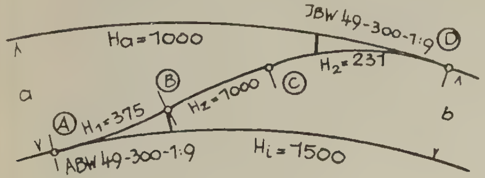


Fig. 8.

At point B, we get $V_{gr} = 49$ km (30 miles)/h and at point C 52 km/h, that is to say the junction *cannot* be taken at 50 km/h. If for the curve BC, we give the radius $H_i = 1\,500$, the calculation gives at B, 52 km/h and at C 49 km/h. What conclusion must be drawn from this observation?

In case 1*b*, the difference between the two radii H_i and H_a is not unimportant. The difference in curvature should not exceed a certain value. If for example we adopt in the case under consideration for the arc BC the mean of the radii H_a and H_i, the junction can be taken at 50 km/h. For $H_z = 1\,250$, the calculation gives at B, 50 km/h and at C, 50 km/h.

Figure 9 shows an example of case 2*a*.

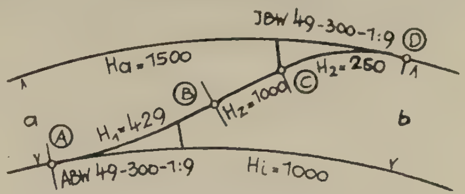


Fig. 9.

We can give up the idea of the complete calculation of the speed seeing that what has been said for 1*a* can be applied in this case.

Finally figure 10 shows case 2*b*.

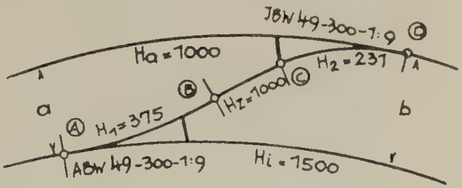


Fig. 10.

Here also, it is not necessary to calculate the speeds, because what has been said under 1*b* can be applied.

The turnouts 1*a* to 2*b* can also be set out by calculating, as was done in figure 4 for parallel tracks, the radius of the intermediate arc BC from the extremity of one turnout to that of the other. But care must be taken not to do so in cases such as these because most often the radius obtained for the intermediate curve does not lie between H_a and H_i, so that once again there will be reductions in speed.

It is also necessary to point out that in the latest regulations of the Bundesbahn should it be necessary to insert a straight length in connections of reverse curvature, the length thereof must be at least equal to $v/10$. This condition is also applicable in all cases to the length of the intermediate curve BC with the proposed method of curvature. The shocks occurring at the points B and C are opposite in direction so that the length of BC is not a matter of indifference. The condition in all cases is therefore:

$$BC \geqslant v/10.$$

We have still to find the maximum difference between the radius of BC and the radii H_a and H_i.

Two reverse curves following one another directly should fulfill the condition $1\,000/H_2 + 1\,000/H_1 \leqslant 9\,000/V^2$. If for a 49-300-1 : 9 turnout, V is taken at 50 km/h, we get :

$$\frac{1\,000}{300} + \frac{1\,000}{H_z} = \frac{9\,000}{50^2},$$

where in $1\,000/H_z = 0.267 = \Delta_k$, or $H_z = 3\,750$; or in other words a 49-300-1 : 9 turnout can be followed by a reverse curve of radius $H = 3\,750$. In the case of a 49-500-1 : 12 and a speed of $V = 65$ km (40 miles)/h, we get $\Delta_k = 0.130$ and for a 49-1 200-1 : 18.5 ($V = 100$ km [62 miles])/h, we get : $\Delta_k = 0.067$.

Applying these to the curvature of the lines to be connected we can write:

a) for junctions with 49-300-1 : 9 turnouts:

$$\frac{1\,000}{H_a} \leqslant \frac{1\,000}{H_i} + 0.267$$

b) for junctions with 49-500-1 : 12 turnouts :

$$\frac{1\,000}{H_a} \leqslant \frac{1\,000}{H_i} + 0.130$$

c) for junctions with 49-1 200-1 : 18.5 : turnouts :

$$\frac{1\,000}{H_a} \leqslant \frac{1\,000}{H_i} + 0.067.$$

If the curvatures of the lines to be connected meet these conditions, H_a equally as well as H_i can be used as radius H_z for the intermediate curve. In any case, there is no difficulty in getting the speed required.

If it is a question of new junctions because of corrections in the location, it is always well to make the calculations above first of all and then layout the tracks. We ought to point out the advantage of applying the method of the diagram of the angles.

What we have just said is also applicable to junctions on curves between curves in the same sense. Here too, if these lines are not concentric it will not do just to connect the ends of the turnouts by an intermediate curve of any radius, but the radius H_z of this must correspond to the speeds. It is necessary to get the condition of curvature shown in figures 7 and 10.

We think we have demonstrated that in junctions on curves the intermediate straight length has an unfavourable effect in the speed. By our method, it is possible to run over junctions on curves at the same speeds as on straight connections.

The preceding conclusions have been verified by the Headquarters of the German Bundesbahn and found to be exact.

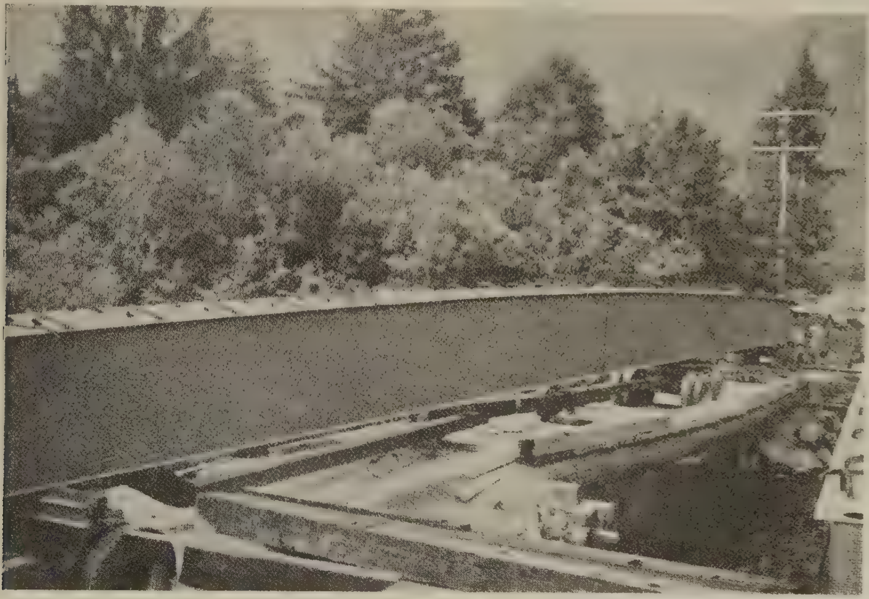
A new type of bridge superstructure.

Low initial and recurring costs are important advantages claimed.

(From *The Railway Gazette*, September 21, 1951).

A new highway bridge has been built over the Snoqualmie River at North Bend near Seattle in Washington State, U. S. A. For the design adopted for the superstructure of this bridge advantages claimed include low constructional cost due to the light weight of the steel required, ease of transport, simplicity in erection and absence of cross bracings, high torsional rigidity, economy in unkeep, and minimum exposure to corrosion.

The bridge has a span of 110 ft. and carries a 22-ft. carriageway and two 2-ft. footpaths; it is designed to American H. 15-44 standard, suitable for feeders to main arterial highways. The design might be economical for railway road overbridges in certain cases, or even be adopted for underbridges.

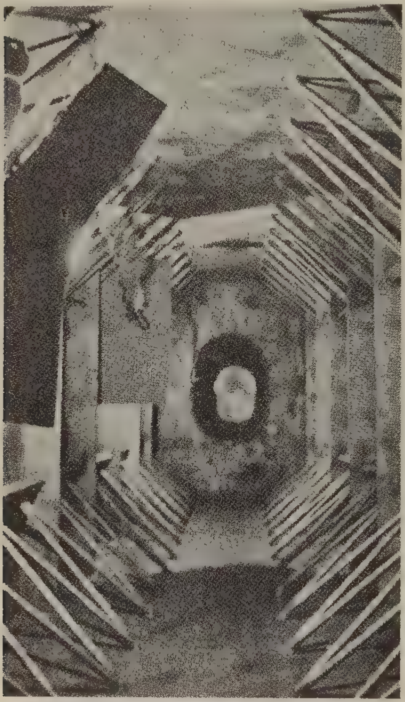


One of the girders being hauled off a lorry; note the inclined semi-circular connector bars welded in two rows to the top flange.

Principal features.

The principal features in the design of the bridge are two light steel box-type main girders composed of 1/4-in. web plates and flanges varying in thickness from 3/8 in. to 5/8 in., fabricated by continuous welding. The boxes so formed have flat unbroken external surfaces, as all stiffeners and a special type of diagonal truss bracing are inside them. Each girders is 4 ft. 0 1/2 in. wide between centres of web plates, and its depth varies from 4 ft. 4 3/4 in. at the ends to 5 ft. 6 in. at the centre, the top flange having a little over 1 ft. of longitudinal camber; it is a hermetically-sealed box with sealed manholes at the ends.

In addition to the normal type of vertical stiffeners, there are four diagonal corner truss bracings in the form of continuous W-trusses, and also four longitudinal stiffening plates welded along the web at the points where the diagonal truss bars join the web. These plates are 3 in. × 1/4 in. and the diagonal trusses are 3/4-in. bars. There are also 5/16-in. diaphragms fitting the box and spaced about 22 ft. apart along its length.



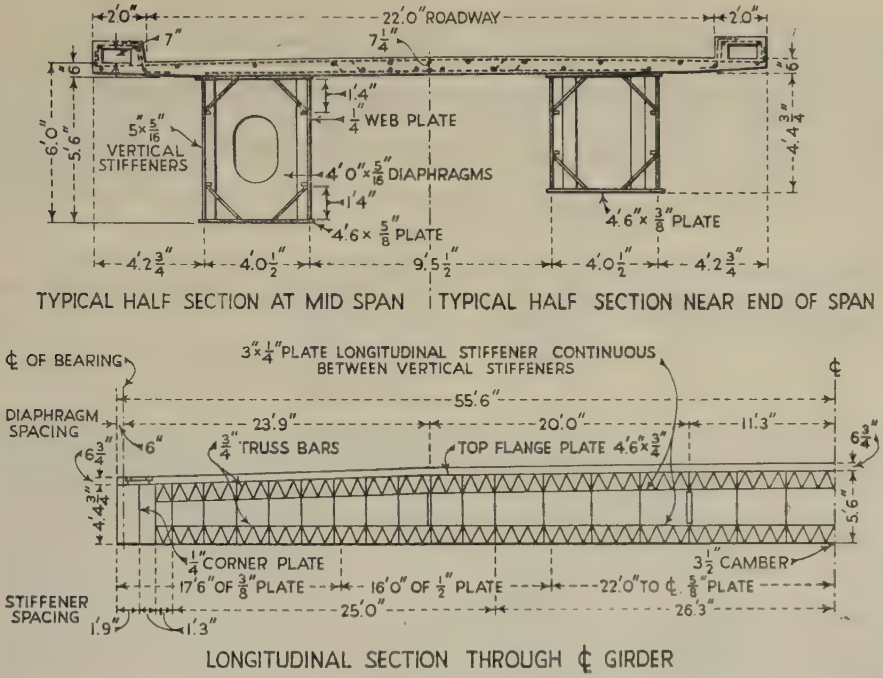
Interior of box girder showing diagonal corner trusses, vertical and horizontal stiffeners, and diaphragms.

Along the top flange plate twin rows of 2 in. × 1/4 in. flat connector bars, semicircular in shape, are welded to it; they are inclined at an angle of 30 deg. to the flange and are spaced 3 ft. 9 in. apart longitudinally. One end of each connector bar is welded above the web plate and the other above the inner end of each row of diagonal truss bars. These connectors bond the girder with the concrete deck, and rigidly fix the tops of the diagonal bracing trusses relative to the decking. As there is negligible deflection in the part of the concrete slab over the box, and therefore between the webs, the lower junction points between the truss bars and the longitudinal stiffeners and web plates may also be considered as rigidly fixed. The trusses act additionally in conjunction with the webs and stiffeners as triangular systems spanning from one diaphragm to the next. The only unbraced portion of each web plate is, therefore, the small central space between the upper and lower longitudinal stiffeners. The trusses also act as stiffeners and bracings to the lower flange plate.

This system of internal bracing and stiffening ensures a remarkably stiff girder even with the light plates used, and the fact that all the material is as far as possible from the longitudinal axis makes for maximum torsional rigidity also. For these reasons no crossbracing between the two girders is necessary, apart from the reinforced concrete deck, which has a maximum thickness of only 7 1/4 in.

As a result of this design, each 110-ft. girder weighs only fractionally over 16 tons, and, apart from the decking — which itself is light — the complete superstructure weighs only 32 1/4 tons. Because of their light weight and 4-ft. width the girders are easily transported, stacked and erected, as the lower flange is horizontal. With the welded box girders hermetically sealed, no internal maintenance should be necessary and corrosion is reduced to a minimum.

Inspection of the interior is facilitated by the manholes and apertures in the diaphragms. Externally, the flat plates, unbroken by such excrescences as stiffeners and wide flanges, are easily and quickly cleaned and painted. For this information and for the illustrations reproduced we are indebted to our contemporary *Engineering News-Record*.



Details of box girders. All shop connections are welded and the method of securing rigidity is shown.

Box-girder span of 110 ft. over Snoqualmie River, North Bend, Washington State, carrying a 22 ft. carriageway.

[624 .32 (45)]

The new railway and road bridge over the Ticino at Sesto-Calende (Italy).(*)

(*L'Ossature Métallique*, March 1952.)

Among the work of restoration on the network of Italian roads and railways, the reconstructed bridge over the Ticino at Sesto Calende, on the Simplon line, is of particular interest.

This consists of a continuous trellis girder bridge, having in all three spans, of a total theoretical length of 263.80 m (881′ 11″). The shore spans have a length of 82.40 m (270′ 4 1/4″), while the central span is 99 m (324′ 9 3/4″) long, a record length of span for bridges of this type on the railway.

The main girders, having a theoretical height of 13.63 m (44′ 8 3/4″), are of the trellis type with triangular meshes. The panels measure 10.22 m (33′ 6 7/16″) and 9.84 m (32′ 3 7/16″) respectively for the shore spans and the central span of the bridge. As a result, the various parts consti-

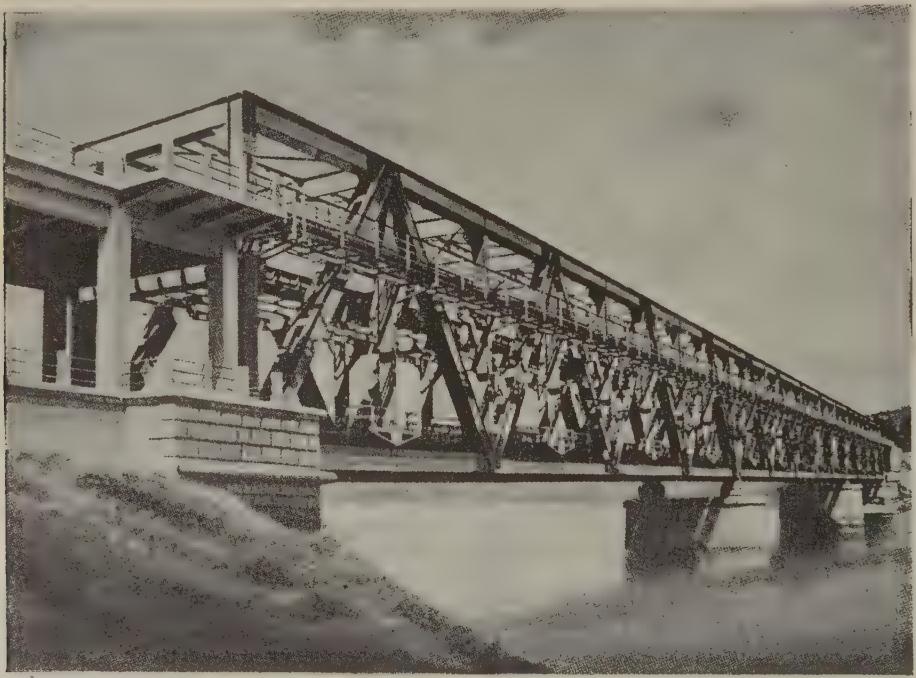


Fig. 1. — General view of the bridge over the Ticino at Sesto Calende.

(*) From the article by Dr. A. Fava, Engineer, in the Italian Review *Costruzioni Metalliche*, N° 4, 1951.

tuting these panels represent an important weight with a maximum of 27.5 t for the part of the upper members of the girder placed in line with the piers.

The system of supports is made up of closed frames at three levels. The lowest frame carries the railroad on two separate tracks. The deck for this stage is supported by cross girders 8.20 m (26′ 10 7/8″) theoretical span, bearing on the uprights of the main girders.

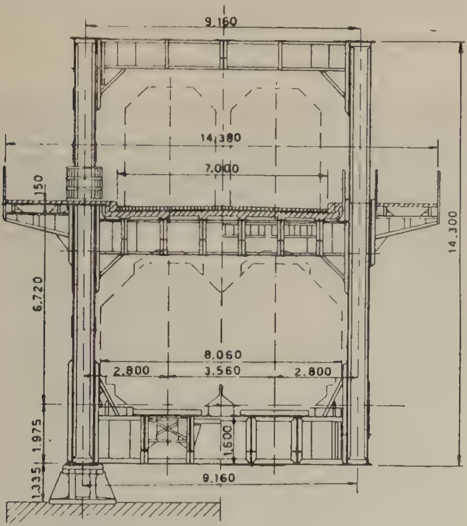


Fig. 2. — Cross section of the bridge.

The deck carrying the roadway is supported by the intermediate framing. This consists of bearers having the same span as those of the lower frame. These bearers are spaced 1.30 m (4′ 3 3/16″) between centres; they support an armoured concrete slab 18 cm (7 3/32″) thick with stiffening ribs.

The upper portion of the frame forms the upper wind-bracing of the bridge. In the construction of the Sesto Calende bridge, the following steels were used :

— For all parts of the main girders excluding the chequer plates for platforms, for rolled sections and large flats (Ag 50, UNI 743 plates - Ag 53′ UNI 815) with maximum permissable stresses σ adm = 18 kg/mm² (11.43 tons per sq. in.);

— For the chequer plates for platforms, A 34 UNI 815;

— For the rivets, AE 44, with max. permissible tensional stress σ adm = 13 kg/mm² (8.254 tons per sq. in.);

— For cast steel supporting pieces Ag 52 UNI 671 with maximum permissible tensional stress σ = 14 kg/mm² (8.889 tons per sq. in.).

Among these materials special mention should be made of the high resistance steel AE 44 which the interested authorities have allowed to be used for rivets with a max. permissible tensional stress σ adm = 13 kg/mm² in place of the usual steel Ag 34 hitherto generally used in Italy for rivets [σ adm = 10 kg/mm² (6.349 tons per sq. in.)].

The calculations for the various elements do not call for any special remark, except in respect of the double frames which are uncommon in bridge design.

Plate adapters.

The plate adapters are made up of the following units :

1. The crossties for the railway bridge decking.

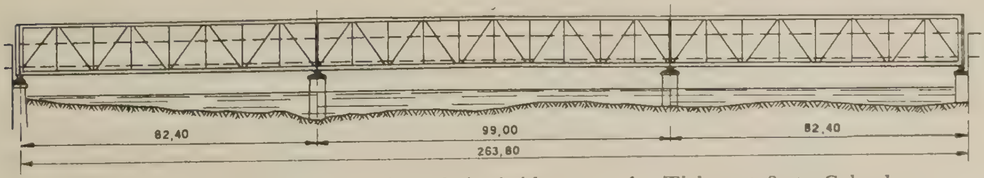


Fig. 3. — Longitudinal elevation of the bridge over the Ticino at Sesto Calende.

2. The sleepers for the road bridge decking.
3. The upper wind-bracing.
4. The uprights for the main girders.

In the calculations, it is understood that all the horizontal forces are transmitted to the end frames by means of the wind-bracing beams. Thus each frame forms a symmetrical double frame, in which only the intermediate and lower cross-beams are stressed by vertical forces.

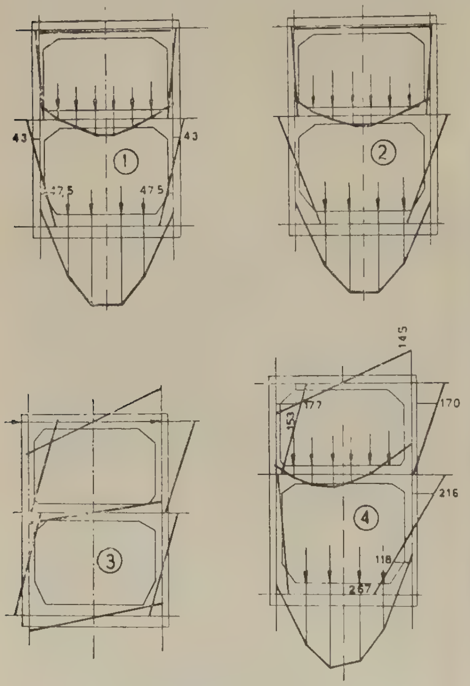


Fig. 4. — Diagrams of the bending moments involved.

The moments at joints are calculated by applying the *theorem of 4 moments* (1). The determination of the moments at the supporting posts enables in their turn the calculation of the value of the moments in all the elements of the frames. These moments are shown on the diagram 1 (fig. 4).

In the uprights of the main girders, we have to add to all the tensile bending stresses due to these moments, the tensile stresses produced by the axial forces (reactions due to the cross-beams).

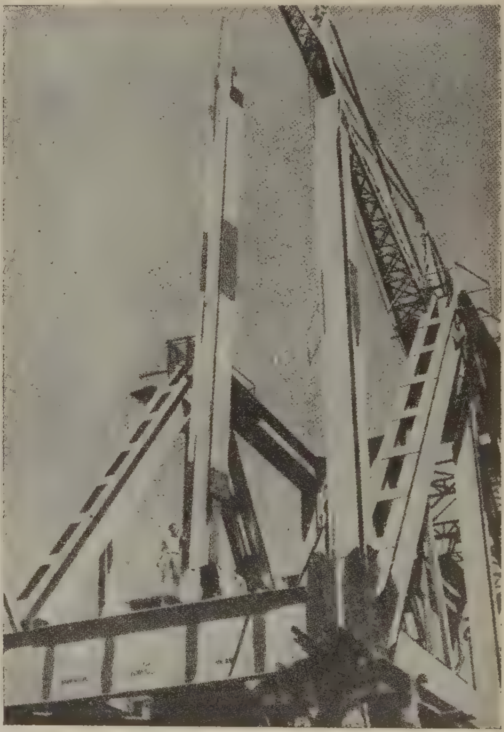


Fig. 5. — Erection of the upper parts of the main girders.

Frames for the end panels.

The end panel frames correspond to supports at abutments and on piers.

The calculations worked out for these structural items give us a diagram of bending moments shown in fig. 4 (diagram 2).

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(1) This formula known as the « Formula of the 4 moments » was independently arrived at in Belgium in 1904-1905, by Professor KEELHOF and on the other hand also by the engineer Gustave L. GÉRARD, who applied it to a T-headed road bridge having three spans.

The end frames are equally stressed by horizontal forces which produce in the frame the moments shown in diagram 3 (fig. 4); in diagram 4 (fig. 4) are indicated the maximum bending moments due to the combined effect of vertical and horizontal forces.

The Italian State Railways have entrusted the work on the metal superstructure and on the reinforced concrete decking to the firm *Carpenteria Bonfiglio & Co.* of Milan.

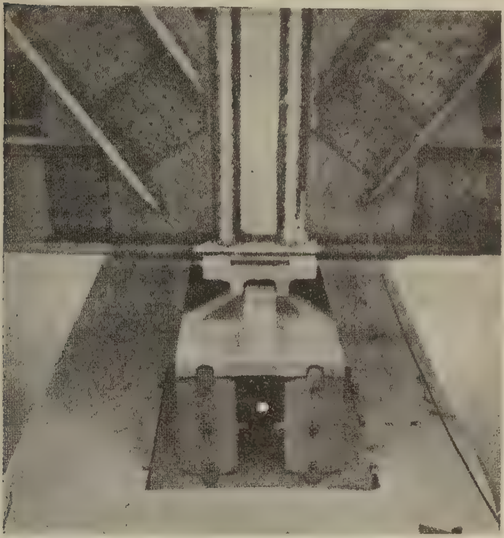


Fig. 6. — Arrangement of the mobile supports.

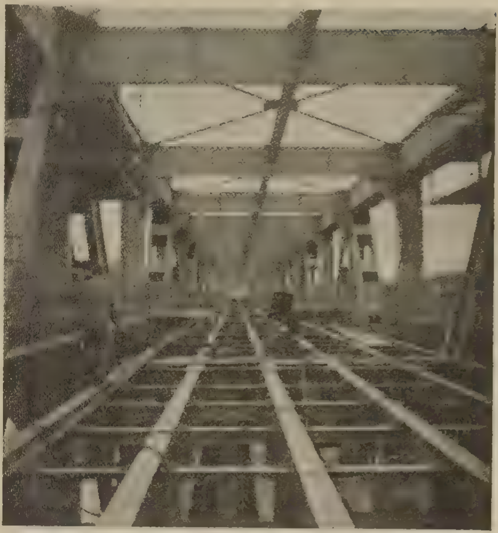


Fig. 7. — End view of the road bridge.

The work was supervised by the Railway Administration (Milan). Plans were worked out based on :

The State Railways Specifications for Class « A » lines equipped for a maximum speed of 150 km (93 miles)/h.

— The current regulations of the Ministry of Public Works for road bridges carrying heavy traffic.

[656 .222 .5 (43)]

The passenger traffic considered from the economic point of view.

(From the « *Eisenbahntechnische Rundschau* », No. 7, July, 1952.)

In a thorough study, Dr. Eng. E. h. Adolph GERTEIS, former Reichsbahndirektionspräsident, analyses under the above heading, in the « EISENBAHNTECHNISCHE RUNDSCHAU » for July 1952, the financial effects of the operating results relative to passenger traffic on the general economic situation of the Deutsche Bundesbahn. He advocates, on the other hand, various measures susceptible to remedy to the present situation.

We believe that it will be of interest to our readers to reproduce hereafter the RESUME, which ended the article written by Mr. GERTEIS, which in our opinion gives the synthesis of the points of view of the author on this important question of passenger traffic, still in the forefront for most railways.

The examination of the financial situation of the Deutsche Bundesbahn and of its economic results, as shown by the operating expense accounts, reveals that amongst the various sources of revenue, slow passenger traffic shows the greatest losses :— i. e. in 1950, and presumably also in 1951, a deficit of more than 500 million DM. Despite the surplus from express and fast train services, overall passenger traffic shows a loss of 200 million DM on working expenses and 300 million DM on prime costs.

The possibilities of improving the operating coefficient by a reduction in expenses are the subject of a careful study. Such possibilities are chiefly realized by reductions in the operation of secondary railway lines, electrification of main lines, and in particular by the motorization of light and medium traffic. All these measures may in the course of time bring a saving in expenditure of 100 million DM per annum.

The main cause for the loss on slow passenger traffic is attributed to inadequate tariffs for professional and school children's traffic, which makes up the bulk of train-kilometres run by slow passenger trains. Receipts from this traffic cover working expenses by only 33 to 40 %. An examination of the tariffs, however, reveals that by reasonable increase for both types of traffic an additional income of no more than 35 million DM could be expected.

It appears therefore that for the time being a deficit in passenger traffic of 65 to 165 million DM (working expenses and prime cost respectively) will be unavoidable, unless further reductions in expenses or increases in revenue can be achieved.

A considerable acceleration of slow passenger trains in a modern suburban and inter-urban service, with up-to-date vehicles will certainly reduce costs, increase revenue and serve travel propaganda.

However, the difficult reduction in expenses, the modernization of slow passenger services, as well as the increases in tariffs, are not even sufficient to cover the losses on overall passenger traffic, leaving alone those on slow passenger traffic. The old method of balancing the deficit at the expense of freight traffic is no longer practicable in view of the competition with independent transport organizations. It should be the aim, not only to ensure to the railway — which is very liable to peaks and troughs — an essential share of traffic at fair prices, but to coordinate all traffic which is now too expensive.

Should this not be achieved in the near future, the time is not far distant when the German Federal Republic as trustee of public economy and likewise owner of the Deutsche Bundesbahn, will have to accept responsibility not only for the losses accruing from common economic tariffs, but for those attributable to such an administration system, as well as for losses resulting from the reconstruction of the Deutsche Bundesbahn.

[656 .225 & 656 .261]

Collapsible containers.

(L'Ossature Métallique, April 1952.*)*

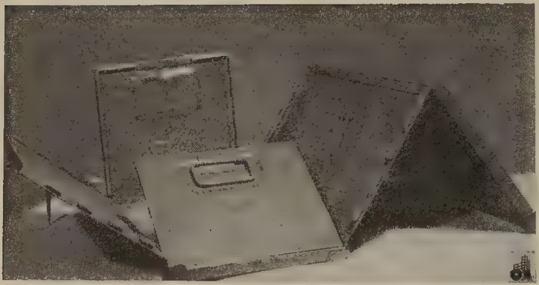


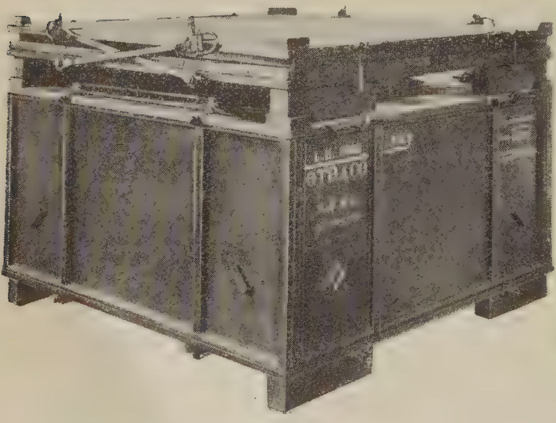
Fig. 1.

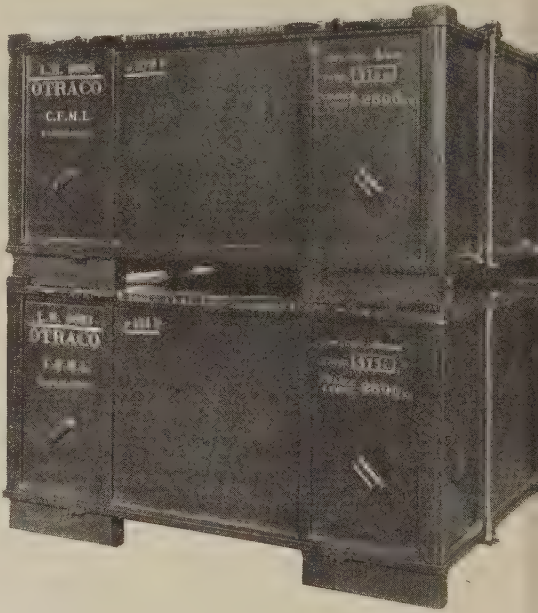
A new type of container has just been put upon the market. This is an « all steel » collapsible container the essential components of which are a base, four articulated side panels and a top.

With the « A. L. D. » pattern of the « Grosses Forges & Usines de La Hestre », the useful capacity is 4.2 m³ (5.49 cubic yards) whereas folded this container only takes up 1.52 m³ (1.98 cubic yards) space (fig. 2). It is 1.2 m (3′ 11 2/8″) high when in use, but only 0.325 m (1′ 3/4″) when folded to facilitate handling or stowing it when empty. It is therefore very easy to deal with, whilst conserving when loaded, all the advantages of easy handling, either from the ground when it can be picked up by a fork-lift truck or mounted on rollers, or by lifting gear if cranes or loading poles are available.

The containers can be consigned in stacks of three, whereas when returned empty they can be piled one on top of the other to

Fig. 2. — « A. L. D. » collapsible containers open and closed.





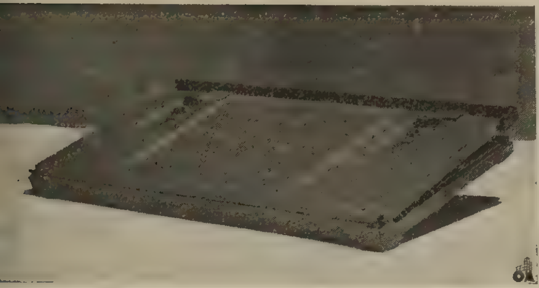


Fig. 3. — « Collico » container in its folded position, the cover being fastened to the base.

any desired number thanks to the fact that they are collapsible.

As all parts are interchangeable, the « A. L. D. » container is very easily maintained, besides which it has several very valuable features, such as cross pieces supporting the partitions for clamping the goods. They can therefore be used for transporting bottles, while they fit so closely that goods in powder form can be sent in them in bulk.

This container can be sealed, and offers every guarantee, not only against theft but also as regards damage.

As it can also be adopted for special kinds of traffic, perishable goods, and fragile goods, thanks to having the sides lined with plastic materials, etc. it can be appreciated that this new type of container facilitates the consignment of the most diverse sorts of goods at any time and to any place. In addition, it has all the essential advantages of a collapsible container which takes up no space when not in use.

This characteristic has been obtained without any mechanical complications and without detracting from its strength and rigidity, qualities confirmed by a great deal of hard service, such as those of the General Transatlantic Company.

In Central Europe, a hire service has been introduced in connection with some new collapsible metal containers. These containers are made of 1 mm (3/64″) thick steel sheet, reinforced by rims, bosses and swages, fitted with corner protectors, easily closed, and fitted with handles against the sides by springs.

In addition to the trade mark « Collico » and the number of the model, each container is stamped on the cover, front and back with its own number.

To date containers of the C 36 and C 48 types (29 × 30 × 33 and 38 × 40 × 83 cm = 11 7/16″ × 11 13/16″ × 13″ and 1′ 3″ × 1′ 3 3/4″ × 2′ 8 5/8″) have been put into service. These models hold 55 and 130 l (12 and 28.6 gallons) respectively and weigh, empty, about 10 and 16 kg (22 and 35 lbs.), and can take up to 400 kg (880 lbs.).

Two other models made of light metal of 100 × 50 × 50 and 120 × 60 × 60 cm (3′ 3 3/8″ × 1′ 7 11/16″ × 1′ 7 11/16″ and 3′ 10 1/4″ × 1′ 11 5/8″ × 1′ 11 5/8″) will be put into service as soon as a sufficient number have been manufactured.

The inventor of these patented containers is Charles Dahmen.

They are hired out by the Collico Hire Company at Solingen Ohligs.

The minimum fee is less than the sum it would cost to reconsign a container. For permanent rentors, the rates vary over a month.

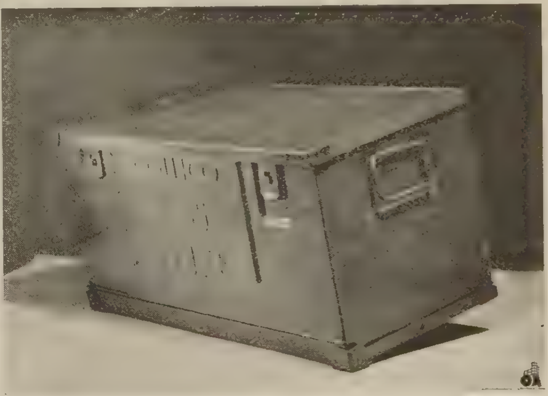


Fig. 4. — « Collico » collapsible containe in the open position.

By reducing the cost of hiring, the industry is able to manufacture to some extent directly for the recipients. In addition, the wholesaler and retailer can divide up the goods without intermediate handling, as these containers can be used as shelving. After taking off the top and removing two pins, the front can be dropped down.

Theft is made difficult, as there is nothing to show what these containers hold. They all look the same and are only identified by their numbers. By means of these numbers, too, should the waybills be lost, it is easy to ascertain the name of the last consigner and last destination, or in the case of containers on permanent hire, the name of the rentor.

Fig. 1 and 3 show how the containers can be dismantled; after taking the pins out at the four corners, the sides and cover can be folded onto the bottom without detaching them. It is very easy to assembly or collapse these containers, and the whole job only takes half a minute.

When folded, the containers only take up about 10 % of their volume in service.

The photographs reproduce in fig. 1, 3 and 4 were sent us by the Collico Company of Erschwil (Switzerland).

NOTICE TO READERS.

We wish to draw the attention of the readers of our monthly BULLETIN on the GENERAL TABLES for the period from the 1st January 1914 to the 30th June 1940, which have been published by our Editorial Committee.

This work contains for the above mentioned period :

1) the General analytical table of articles arranged according to the decimal classification;

2) the alphabetical index referring to the numbers of the universal classification;

3) the alphabetical table of author's' names; and

4) the table of documents appertaining to the Congress in the order of the questions dealt with at the five last Sessions (9th, 10th, 11th, 12th and 13th) and at the Enlarged Meetings of the Permanent Commission of 1935 and 1939.

Some copies of this publication are still available and may be obtained on application to our Secretariat, 19, rue du Beau-Site, Brussels. *(Price : 250 Belgian Francs.)*

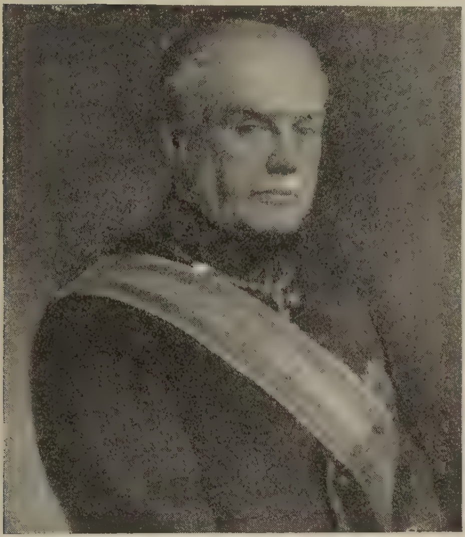
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION.

[385. (09 .2]

OBITUARY.

Rafael BENJUMEA BURÍN, Count of GUADALHORCE,

President of the Administrative Council of the Spanish National Railways.
Member of the Permanent Commission of the International Railway Congress Association.



We have learnt with great regret of the death in Malaga on the 26th September last of Don Rafael BENJUMEA BURÏN, Count of GUADALHORCE, President of the Administrative Council of the Spanish National Railways and a Member of the Permanent Commission of our Association.

He obtained his degree of Engineer of Highways, Canals and Harbours in 1901, after a brilliant career at the University in which he took first class honours, and his first work was the designing and carrying out of various hydraulic schemes amongst which must be mentioned the « El Chorro » dam, considered to be one of the most genius contemporary engineering feats. This dam was inaugurated by His Majesty King Alphonsus XIII, who rewarded M. BENJUMEA by conferring on him the title of Count of GUADALHORCE. He was also responsible for the Jandula dam, afterwards conceded to the Guadalquivir Canal and Irrigation Company, and which formed the basis of this extensive undertaking.

In 1925, he was appointed Minister of Public Works under General Primo de Rivera's government. His ministerial activities were so vast and transcedent that they far exceed the narrow limits of a biography. It was to his initiative that the Circuit of Special Roadways is due, covering 7 000 km (3 700 miles) of roads, as well as the preferential Plan for the construction of 1 600 km (1 000 miles) of railway, and the creation of the Hydraulic Confederation, which can be considered one of the most original and valuable conceptions of the social genius of our time.

After leaving the Ministry of Public Works, and after a stay in Paris, the Count of GUADALHORCE went to the Argentine, where he founded the Hispano-Argentine Company of Public Works and Finance which undertook the construction in Buenos-Ayres of four Metropolitan Railway lines, which are now run by the City of Buenos-Ayres Transport Corporation.

In 1948, he returned to Spain to become President of the Administrative Council of the RENFE, from which time, in spite of his advancing years, he devoted himself with the utmost activity to improving the operating conditions of the Spanish Railways. These, as a result of the civil war, were in a very bad state, both as regards traction and rolling stock and the permanent way, with considerable delays in any improvements to the operating due to the suppression of any programme of works during that period. Faced with such a situation, and as a result of a careful study of the characteristics of the railway system, the Count of GUADALHORCE judged it to be absolutely essential to draw up a programme which by reducing the costs would balance the operating budget and bring about a satisfactory financial situation, capable of meeting future requirements from its own resources.

On such a basis, he prepared and put before the Government his General Reconstruction Plan, which was approved in May 1949 and extended to cover 12.7 thousand million pesetas. This Plan includes, amongst other things, the reconstruction of the permanent way and fixed installations, the enlarging and improving of the motor and rolling stock according to up-to-date ideas, the improvement of the signalling and communication systems, as well as the electrification of 1 360 km (840 miles) of lines.

He died just when he was devoting all his activities and enthusiasm to the realisation of this enormous task.

His remarkable career was crowned by many flattering decorations awarded by Spain and other countries. He held the Great Cross of Isabella the Catholic, of Charles III, of the Crown of Italy, of Christ of Portugal, of the Legion of Honour, as well as other Spanish and other decorations. He also had the title of « Maestrante de Ronda » and was Honorary President of the Council of Public Works and a Member of the Academy of Moral and Political Sciences.

With the death of the Count of GUADALHORCE disappears one of the most illustrious figures of contemporary Spanish life. His considerable labours in the field of public works will live as an example of what can be done by constant activity directed by an indomitable will. The Count of GUADALHORCE was not only an exceptional engineer but also the promotor of impressive schemes which he succeeded in bringing to completion by the irresistible power of his extraordinary personality.

The Count of GUADALHORCE was nominated a Member of the Permanent Commission of our Association at the Meeting of the 1st March 1952. In spite of his many activities, he always showed the greatest interest in the work of the Congress. At the Madrid Session in 1930, he was Honorary Vice-President of the Local Spanish Organizing Committee.

We offer his family our sincere sympathy.

The Executive Committee.

NEW BOOKS AND PUBLICATIONS.

[**385** (08 (59)]

SANDERS (J.O.), G.M.G., M. Inst. T., A.M. Inst. C.E., General Manager of the Malayan Railway. — **Malayan Railway Administration Report for the year 1951** — One brochure (7 7/8 × 13 in.) of 42 pages, illustrated, one map. — 1952, Kuala Lumpur, The Commercial Press.

This report, like the previous ones, groups the data and remarks relating to the financial results, the evolution of the traffic and the activities of the various departments into eighteen chapters. The appendices — there are 27 — contain data of a more detailed financial nature and further statistics, especially as regards the rolling stock and services.

The year is summed up in a note « General Review » which is the subject of chapter I. Once more the gross receipts for the undertaking as a whole reached a record figure, exceeding those for the previous year by 23.5 %. The increase in expenditure was of the same order : 24.3 %. The balance, once the various allocations had been pruned off, did not permit of the desired increase in the renewal fund. The amount of the contribution to this fund was fixed at 3 % of the replacement value of items subject to wear.

The goods traffic showed no particular changes. But the receipts increased owing to the higher rates, which came into force after May 1st. In the case of the passenger traffic, there was a falling off in the number of first class passengers, a slight increase in the number of second class passengers and a further increase in the number of third class passengers. There was also an increase in the number of parcels and other goods carried by passenger trains.

The receipts from the harbours (there are five) and the ferry services were affected by the improvement in traffic and the higher rates.

During the year under consideration, political troubles (acts of terrorism) again hampered the working, holding up the traffic particularly at night, lengthening the turn round of the stock, and causing a considerable increase in cost. In spite of these unfavourable circumstances, the restoration of the system was actively continued, in spite of other difficulties. Amongst the work undertaken or completed are metal bridges, shops, buildings, rebuilt lines, 18 miles of which were opened to traffic on the 1st September.

The wages of the staff were increased during the year, which explains to some extent the rise in the operating costs. The balance of the increase is due to the higher prices of stores and fuel, especially imported coal. The Management continues to take an active interest in the moral and material welfare of the staff, as well as in its education and professional training. From the health point of view, the greatest preoccupation remains the battle against malaria. Experience obtained during the year has led to the adoption of a D.D.T. emulsion to be used as an insecticide during 1952.

It appears that there are great traffic needs still to be met, and if the political and economical conditions improve, the railway cannot fail to enjoy an era of prosperity, whilst meeting the vital requirements of the country.

E. M.

[**385** (42)]

Facts and Figures about British Railways. — One brochure (4 × 6 1/2 in.) of 32 pages. — 1952, published by The Railway Executive (British Railways), 222, Marylebone Road, London N.W. 1.

The law on the nationalisation of transport, which came into force on the 1st January 1948, brought under the same management a total of 19 357 miles of railway lines. No other European railway can boast of a comparable mileage And from the point of view of the amount of traffic, the British Railways lead all the railways of the world.

This publication continues and brings up to date the work published jointly by the former Companies in 1947. The object of this new edition is to lay the principal facts before those concerned together with figures showing the characteristics of the unceasing activity of the busiest railway in the world.

The book gives the essential data relating to the general situation and various departments which share the work involved in running a large railway : the financial results, the traffic, the rolling stock, the equipment of the permanent way, the track, the staff, the rates.

Amongst such a collection of figures, each one of which is significant, it is difficult to pick out any special item. Mention may however be made of the following facts : there are 40 000 trains a day carrying 3 000 000 passengers and 1 000 000 tons of goods, and the receipts amount to more than £1 000 000 a day. The railway carries 77 % of the coal from the mines before it is loaded onto lorries. It is one of the largest employers of labour in Great Britain and the best client of the national industries.

The basic third class rate is 1 3/4d per mile with a luggage allowance of 100 lb.

425 express goods trains are run every day, 134 more than pre-war. The use of containers has developed to such an extent that there are now 24 000 in use.

As regards steam locomotives, the standardisation programme aims at reducing the number of standard types to 12. The new types of passenger coaches, the first of which appeared in 1951, are made entirely of metal. Many of the most widely used types of wagons belong to standardised classes.

As regards the permanent way, the flat bottomed rail has been selected to replace the bull-headed rail and the sections adopted have a much greater strength than those given up in principle. In the case of signalling, the striking facts are the extension of colour light signals, the installation of new all-electric signal-boxes, and in the case of manually operated signals, the preference given to semaphore signals with arms that lift up.

We will terminate our brief summary here, and leave it to our readers to satisfy their awakened curiosity by reading this substantial and stimulating little book.

E. M.

[**385** (08 (460)]

RED NACIONAL DE LOS FERROCARRILES ESPAÑOLES. — **Memoria del Consejo de Administracion. Ejercicio de 1951** *(Spanish National Railways. — Report of the Administrative Council for the year 1951).* — One volume (8 1/4 × 12 1/4 in.) of 188 pages.

This report follows the same plan as that for the year 1950. The information given on the activities of the railway and the results obtained are grouped into eight chapters as previously indicated (see *Bulletin* for October 1952), with however a slight modification in that the additional services now have two chapters devoted to them, one dealing with forestry activities and the other with the road transport services.

In the preliminary note, it is shown that the traffic receipts have improved, thanks to the better economic situation. However, as the expenses increased to a relatively greater degree, the operating account ended in the red. There was more business at the end of the year and the traffic units as a whole exceeded those of 1950 by 5.3 %.

The improvement in the services is shown by the greater number of train-kilometres, both passenger and goods, by the running of faster trains, and a more favourable coefficient of user for the wagons.

In the case of the goods traffic, the improvement is mainly due to the slow goods services. Passenger traffic, 86.02 % of which was third class, only accounted for 28.9 % of the total traffic.

Amongst the most striking facts reported in the preliminary note is the carrying out of the general reconstruction plan, the permanent way works, the modernisation of the rolling stock, the electrification schemes and the safety installations. Very detailed information is given on these points and various others in the body of the report.

Taken as a whole, this report bears witness to the continuity of the efforts made to modernise the railway and its equipment, and to increase the output thanks to improvements in the operating methods.

E. M.

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Convegno sulla Difesa del Suolo e le Sistemazioni fluviali e montane *(Congress of Soil Conservation and the Management of water courses and mountains)*. Supplement to the « Ricerca Scientifica », volume 22, No. 4, 1952. — One volume (7 1/2 × 9 7/8 in.) of XXIX-316 pages, illustrated. — 1952, Rome, published by the « Consiglio Nazionale della Ricerche », Piazzale delle Scienze, 7 (Price : 1 500 liras).

On the occasion of the 30th International Fair at Milan (1952), the National Research Council organised some « Scientific Days ». These consisted of two scientific Congresses and an exhibition in the new stand occupied by the « Consiglio Nazionale della Ricerche ».

The subject of the first of these Congresses, held from the 16th to the 19th April 1952, was « Soil conservation and the management of water courses and mountains ». This Congress is reported in the volume under review.

The work of the Congress was devoted to soil conservation and all the hydrogeological problems upon which it is based, the management and putting to profit of the mountains (i. e. forests, pasturelands and arable), the regularisation and utilisation of the water courses of the mountains and plains.

Many Italian scientists and technicians took part in this Congress. The patronage of the Government and the participation of several Ministers, other official organisations and various scientific and industrial companies showed the interest it aroused in the country.

The meetings were not limited to the presenting of reports on any special questions. They ended in discussions in which a great many of those present took part, either by impromptu remarks or by new reports on the questions raised.

For convenience, the full text of the reports has been given in the second part of the book. The speeches made at the inaugural meeting, honoured by the presence of the President of the Republic, are also given in full. The first part gives a very complete though brief account of the Congress and the various ceremonies which took place, together with an analytical review of the meetings.

The very numerous reports and communications, collected together in the second part, deal with soil conservation in all its various aspects.

This Congress, the first such to be held as far as we know, will make it possible for those interested in this business, especially the public authorities, to collect data of great value on the protection and rational utilisation of the riches of the soil. Even those countries, whose contours and hydrography differ from those of Italy will find invaluable information in these reports.

E. M.

[**625 .22**]

HECHLER (L.), Dipl. Eng., Reichsbahnrat. — **Die Umgrenzung des lichten Raumes bei Regel- und Schmalspurbahnen.** *(The loading gauge on standard and narrow gauge railways)*, 2nd edition, increased. — One volume (6 × 8 1/4 in.) of XII — 372 pages, with 173 figures. — 1952, Darmstadt-Berlin, Otto Elsner Verlagsgesellschaft. (Price : cloth bound, 24 D.M.).

This work, which is in its second edition, gives a complete picture of all the German regulations regarding the loading gauge to be allowed for the working of trains.

It also gives all the necessary explanations about the standard gauge and its field of application. The various formulae used are also justified, together with the values of the parameters to be taken into account which enable the modifications involved in certain circumstances to be taken into account.

Within the framework of this study, which appears to be very complete, the author has dealt for example with the question of the gauge of the track on the open line, in stations and sheds, on straight and on curved sections.

In this second edition, he gives and justifies the regulations to be followed on sections of line with overhead contact wires, to ascertain the distances to be left between the signals and the track on such lines. A special chapter deals with the exceptions allowed in the case of the Hambourg and Berlin metropolitan railways.

The appendix, which reproduces the RIV gauge, gives in a new part II the gauges for the stock, the loading gauge and overall gauge for nearly all the railways of Europe.

The information collected in this volume will be invaluable for all construction departments and factories specialising in railway stock.

E. M.

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Bull. of the Int. Ry. Congress, Ass., No. 4, April, p. 185.
LANGLEY (C.A.). — **History and methods of Government regulation of Railway safety in Great Britain.** (10 000 words.)

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Bull. of the Int. Ry. Congress. Ass., No. 4, April, p. 203.
PEPPER (A.L.). — **Cross-channel services of British Railways.** (8 000 words, tables & fig.)

1953 **621** .392 (494) & **624** (494)

Bull. of the Int. Ry. Congress Ass., No. 4, April, p. 227.
FREI (M.). — **A new railway bridge constructed in welded steel.** (2 400 words & figs.)

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Bull. of the Int. Ry. Congress Ass., No. 4, April, p. 237.
Official information issued by the Permanent Commission of the International Railway Congress Association. — **Meeting held by the Permanent Commission** in Brussels, on the 17th January 1953. *Appendix* : List of members of the Permanent Commission (17th January 1953). (2 000 words.)

MONTHLY BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS ASSOCIATION
(ENGLISH EDITION)

PUBLISHING and EDITORIAL OFFICES : 19, RUE DU BEAU-SITE, BRUSSELS

Yearly subscription for 1953 :		
	Belgium	**700 Belgian Francs**
	Universal Postal Union	**800 Belgian Francs**

Price of this single copy : 80 Belgian Francs (not including postage).

Subscriptions and orders for single copies (January 1931 and later editions) to be addressed to the General Secretary, International Railway Congress Association, 19, rue du Beau-Site, Brussels (Belgium).

Orders for copies previous to January 1931 should be addressed to Messrs. Weissenbruch & Co. Ltd., Printers, 49, rue du Poinçon, Brussels.

Advertisements : All communications should be addressed to the Association,
19, rue du Beau-Site, Brussels.

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An edition in French is also published.